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AVIATION

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AVIATION PRODUCTS

Flashes

Picked Up Along Editorial Airways

» THE C.A.A. CAN SLEEP comfortably nights now that the Senate has confirmed all the appointments originally made by the President. Not that we had expected anything different, but there had been persistent rumors of possible upset—and you never can tell what a bunch of senators may do when they sit down and put their heads together. There, at least, is one more bit of red tape out of the way.

» THE ALLEN APPOINTMENT to the Number Three spot on the Safety Board came as a bit of a surprise, but, as with a number of other surprising moves that have been made in Washington lately, it will probably work out well in the end. As everyone who reads AVIATION knows, we have had our own ideas about the makeup and the functions of the C.A.A. and the Safety Board (you can check up on us by re-reading the editorial which ran on p. 19 of the August, 1938 issue). We know C. B. well enough, however, to be sure that he will mesh in with the work which the Safety Board has already done and will undoubtedly turn in a good job. He has always been noted for his independent expression, and as a newspaper man of long standing, has the ability to get at the bottom of obscure situations—both of which should be decided assets in the work he is now undertaking. His appointment rounds out the list of the Authority's membership, but does not clear up the mystery as to why the final Safety Board appointment was so long delayed.

In This Issue

With so much talk about rearmament programs, and so many confusing accounts appearing in the daily press, we thought it worth while to do a bit of snooping about Washington to find out for ourselves what the score to date really is. Dan Sayre and Blaine Stubblefield wore out a bit of good shoe leather tramping about from department to department to piece together the round-up story on Defense Measures that leads off this issue. . . .Our neighbors to the north are grooming their airplane factories to help out with the lagging British rearmament program. Mr. Montagnes has given American readers a birdseye view of Who's Who in the Canadian picture. . . . With flight training methods very much to the fore these days, the Spartan School's system of group cross-country instruction with the Dawn Patrol offers an interesting idea. . . . A picture trip through Lycoming's plant at Williamsport showing production methods on Lycoming engines. . . .The first of a series of three articles by the executive engineer of the Grumman Aircraft Company on the complicated problem of exhaust manifold design. Mr. Titterton's group of practical articles offers material of great interest to anyone who has to do with airplane design or engine installation. . . . Martin's big flying boat for the U.S. Navy is now undergoing flight tests and a limited amount of information on this important project has been released (p. 30). . . . When Fred E. Weick was with the N.A.C.A. he wrote several articles for AVIATION on the development of his simplified airplane, the W1. Now, as chief engineer for Engineering & Research Corporation he has applied the same principles to the Erco monoplane. He gives his own account of the reasoning behind the present design in his article on p. 34. . . .

» FOR AMUSING READING there is nothing better than the record of hearings on almost any subject before almost any Congressional committee. So—when a lot of people named Elmer begin to dabble about with some of the technical aspects of this funny aviation business, almost anything can happen. We offer, for example, the following interchange between one of the Authority members and several distinguished senators, plucked from pages 158 and 159 of the hearings before the Committee on Military Affairs of the U.S. Senate on HR 3791:

SENATOR HILL: Will you please tell us what a helicopter is?

MR. MASON: It goes straight up and straight down without injury to anybody.

SENATOR HILL: You mean the plane does?

MR. MASON: The helicopter.

SENATOR HILL: What we know as the autogiro?

MR. MASON: No, the autogiro relies on forward motion to continue its support, similar in a sense to an airplane.

SENATOR HILL: In other words, you would have to go forward while you are going up?

Where young men are happy and the ultimate in an aeronautical education is acquired

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The students live at the school throughout their academic period in student rooms—two to a room. Normal medical and dental attention, laundry, and board are furnished as an integral part of this course. The students are supervised at all times in recreational and social activities by competent prefects. Social functions are given throughout the year—supervised athletics are part of each course—boxing, swimming, and other major sports are included.

FATHERS: If your son has a high scholastic standing and wants to enter an aeronautical school, use the coupon and see the advantages this school, with its 4-year course, offers.

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MR. MASON: Yes sir, in an autogiro. But the helicopter will go straight up or stand literally in one place. . . .

SENATOR HILL: We have nothing like that at all?

MR. MASON: No sir.

SENATOR BRIDGES: How do you spell that?

MR. MASON: H-e-l-i-c-o-p-t-e-r.

SENATOR CLARK: Will the Germans be putting those helicopters on the planes they sold to the French before they put them on for themselves?

MR. MASON: The helicopter is a type by itself.

SENATOR CLARK: You do not think they would sell them to the French before they equipped themselves with them?

MR. MASON: They did not mention helicopter.

SENATOR HILL: Is the mechanism much different from an airplane?

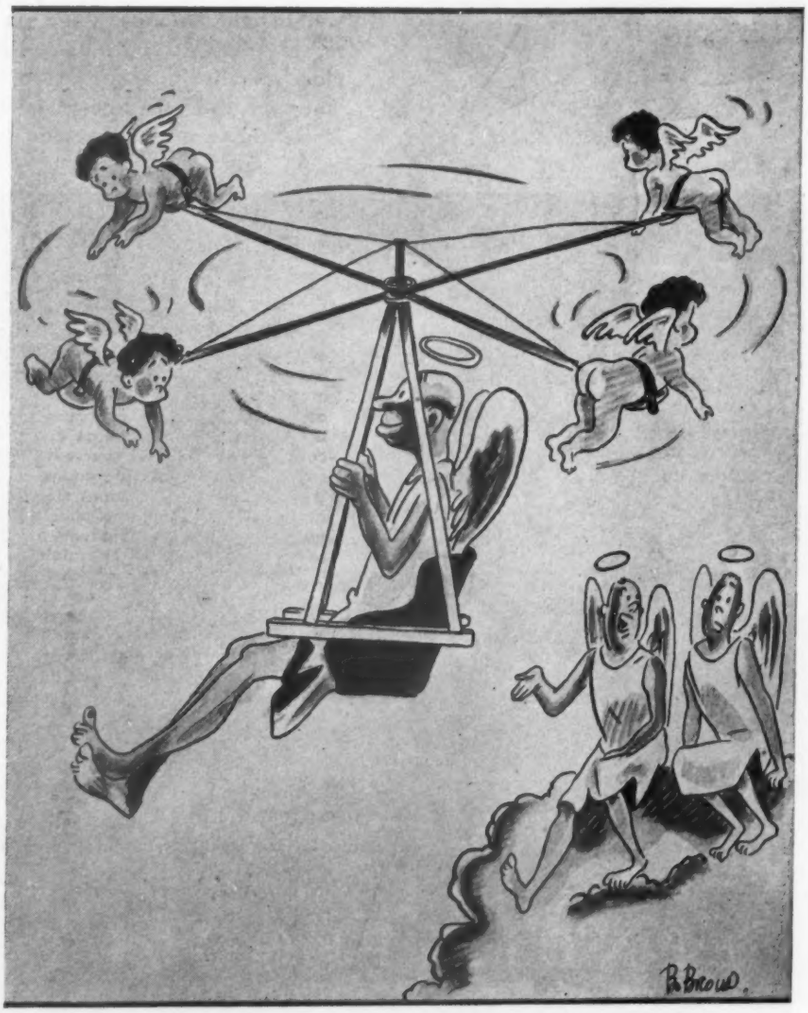
MR. MASON: It is entirely different . . . . (*etc. etc.—far into the night*).

» THE NAVY WONDERED when a recent selection board passed over Captain John Towers. But the situation became clear with the announcement of his appointment to succeed Rear Admiral Cook as Chief of the Bureau of Aeronautics come next June. The appointment, of course, carries with it promotion to the rank of Rear Admiral. Jack Towers' experience covers the whole period of aviation in our Navy. Few officers could be more competent to head up the work of the Bureau during the critical period of activity and expansion that lies in the immediate future. The President has done well to place such an officer in charge at this time.

» IT'S THE LITTLE THINGS that upset plans and change the course of human events. In our own case it was a wandering germ or two that did the damage and rendered us more or less *hors de combat* for almost three weeks (one of which—we must admit—was spent recuperating in Bermuda's sunshine, a kind of medicine that is quite easy to take). Which meant that the rest of the staff had to do a lot of extra scurrying about to cover the events of a busy month. Paul Wooton and Blaine Stubblefield pinch-hit most ably for us at such important Washington events as the National Aviation Forum and the christening of the Yankee Clipper by the First Lady.

» CHIEF REGRET was to miss a chance to fly in the Yankee Clipper when she was in New York. Dan Sayre spent some time aboard her, both on the water and in the air, and reports that she is everything she was supposed to be, and then some. And Dan is a pretty good judge.

» LES NEVILLE TRAVELLED (among other places) to Lock Haven to take part in the Light Plane Distributors Meetings held there under Cub auspices. He reported that the sleepy town of Lock Haven looked almost as though a National Air Race had hit it. The hotels were packed not only with distributors, but with engine and accessory manufacturers, finance and insurance company representatives, and others. Large scale entertaining was sponsored by Franklin, Lycoming, Continental, Lenape, and Interstate Finance. And even in the days when Lock Haven thrived as a lumber town the Fallon Hotel guests never before included a very much alive black bear cub. Outstanding among the speeches were President Piper's humorous account of the company's history and Publisher Thomas Beck's fatherly advice to salesmen. High spot in the ceremonies was the award to Sales Manager St. John of a replica of Ferdinand the Bull.



"Maguire just heard about the Dorsey Rotary Wing Aircraft Bill!"

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ALL your careful forethought, all the long hours of training, all your investment in modern equipment come into clear, significant focus when the ship lands and taxis down the runway.

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Side Slips

By
ROBERT OSBORN

» IT WAS a very nice idea to have Mrs. Roosevelt christen the new "Yankee Clipper" before it is placed in the trans-Atlantic service, but we do think that Pan American could have avoided flying the ship to Washington specially for the ceremony. The flying boat had stopped at San Diego, Galveston and New Orleans on its trip from Seattle to Baltimore, and if it had stayed in any of those places only a day or two Mrs. Roosevelt would certainly have met up with it in the course of her regular travels around the country.

» LINCOLN ELLSWORTH, just returned from three months of Antarctic exploration, announced in Sydney, Australia, his plan for another expedition to the same region. He intends to fly from the Bay of Whales to the South Pole and spend the entire winter there with two companions. Mr. Ellsworth could realize a very handsome profit on this plan if the large democracies of the world were

allowed to select his two companions, and could be assured that the persons they selected would go along.

» "JURY LOCKED UP IN AIRPLANE CASE"—*N. Y. Times* headline found by Mr. R. A. S.

Even though the "all purpose airplane" of bygone years was never very much of a success, it seems that there might be some possibilities of an "all purpose airplane case" now that they are being used for Jury Rooms, as well as for chicken houses, Austin garages, bath houses, trailer bodies and kindling.

» A NEWS ITEM says that because of the spell of bad weather throughout the country recently, an airline passenger trying to fly from Nashville to Knoxville was taken on to Washington. Then he was routed through Pittsburgh, Columbus and Louisville back to Nashville again, as Knoxville was still closed in. From there he went on by train to his destination two hundred miles away, having traveled six times the distance he originally intended.

The Intrepid Aviator was in the office to register a complaint about the cheaper brand of cigars we are now smoking, and in the course of his conversation commented on this incident. He said that he personally would be the first to applaud this conservatism on the part of the air line but thought we ought to be on guard against some wise crack from the railroads about the "Grandfather Clause" in connection with this particular news item.

» AT THE National Aviation Forum in Washington, Mayor La Guardia stated that he will not be satisfied with New York's solution of its airport problem even with the opening of the $30,000,000 North Beach Airport. He said he had his eye on "another piece of property within New York City for an airport to take care of traffic that is bound to come in the future."

Mayor La Guardia has been famous all through his career for the breaking of precedents and now he is running true to form with airports actually in the city they are to serve. Until we learn the location of the "new piece of property" however, we shall continue to suspect that the ancient and honorable aeronautical tradition of municipal airport property being either swamp land or actually under water will still maintain.

» WILL ROGERS' famous comment "All I know is what I read in the papers" can soon be parodied to "All I did can be read on the stamps" if the memorial stamp issues to that patron saint of aviation continue. On March 28th Nicaragua commemorated Will's flight to Managua in aid of earthquake victims. The Nicaraguan 1 cent stamp shows his plane flying to the airport, the 2 cent stamp shows

him stepping out of the plane, the 3 cent stamp pictures him at the Pan-American office, the 4 cent stamp portrays his reception by the U. S. Marines and the 5 cent stamp his ship flying over the ruined city,—which is our idea of not doing things by halves.

» WILL ROGERS certainly was the most enthusiastic of air travelers and his writings on that subject, as well as his example, helped the struggling air lines more than can be readily appreciated. We saw him often, on stage and off, but our best recollection of him was at Roosevelt Field. Someone, we think it was Clarence Chamberlin, took him for a ride in a Bellanca monoplane. As the ship taxied up to the line in front of the large crowd that had collected, Will stuck his head out of the side window and called to Casey Jones, "I was flying her, Casey! I was flying her,—all except them foot jiggers."

» A RECENT NEWS DISPATCH stated that Robert Wadlow, the famous giant of Alton, Ill., had grown to a height of 8 feet 8½ inches on his twenty-first birthday. We are wondering if it wouldn't be wise for Mr. Wadlow to begin wearing a red light on his hat.

AVIATION ★ ★

★ ★ ★ ★ ★ *for April, 1939*

The Navy too has an ambitious expansion program: New planes for several more carriers. Many more big patrol bombers. Over a dozen new bases. Above a new scout observation plane built in the Naval Aircraft Factory shows its rough water prowess.

The Army shows Congress what it would buy

Wide World

Measures for Defense

Our "Air Defense Program" is no simple thing covered by one or two simple pieces of legislation. Important bits of it are scattered through half a dozen pending Congressional measures. Here is how it has shaped up to date.

By

Daniel Sayre and Blaine Stubblefield

Associate Editor, AVIATION *Washington Bureau,* AVIATION

ON JAN. 12TH President Roosevelt wrote to Congress:

"Careful examination of the most imperative present (defense) needs leads me to recommend the appropriation at this session of the Congress, with as great speed as possible, of approximately $525,000,000, of which sum approximately $210,000,000 would be actually spent from the Treasury before the end of the fiscal year ending June 30, 1940.

"The survey indicates that of this sum approximately $450,000,000 should be allocated for new needs of the Army, $65,000,000 for new needs of the Navy, and $10,000,000 for training of civilian air pilots . . .

"It is proposed that $300,000,000 be appropriated for the purchase of several types of airplanes for the Army. This should provide a minimum increase of 3,000 planes, but it is hoped that orders placed on such a large scale will materially reduce the unit cost and actually provide many more planes . . .

"I suggest that $50,000,000 of the $300,000,000 for airplanes be made immediately available in order to correct the present lag in aircraft production due to idle plants.

"I suggest an appropriation of $110,000,000 to provide 'critical items' of equipment such as anti-aircraft artillery, semi-automatic rifles, anti-tank guns, tanks, light and heavy artillery, ammunition and gas masks.

"I suggest approximately $32,000,000 for 'educational orders' for the Army . . .

"The estimated appropriation of $65,000,000 for the Navy should be divided into (a) $44,000,000 for the creation or strengthening of Navy bases in both oceans in general agreement with the report of the Special Board which has already been submitted to the Congress, (b) about $21,000,000 for additional Navy airplanes and air material tests.

"Finally, national defense calls for the annual training of additional air pilots. This training should be primarily directed to the essential qualifications for civilian flying. In cooperation with educational institutions, it is believed that the expenditure of $10,000,000 a year will give primary training to approximately 20,000 citizens.

"Devoid of all hysteria, this program is but the minimum of requirements . . ."

Within the limitations of its rules,

Congress pitched in. For over two months and a half now, it has devoted a large part of its time and energies to the proposed program. With the sole important exception of projected harbor improvement at Guam, all Congressional votes during that period have indicated that Congress will ultimately pass every item requested by the President.

Meanwhile, AVIATION readers must understand that this "program" is not something all tied up with ribbons and set out in one or two pieces of legislation. Important parts of it are scattered here and there through at least a half dozen different measures. Many of its details are not matters requiring legislation at all, but will be settled simply by administrative order.

Roughly, the various parts of the program can be broken down into: (1) authorization for increased plane strength; (2) appropriations for such expansion; (3) plans and methods for effecting it; (4) authorizations, appropriations and methods of training for the required increases of personnel; (5) authorizations and appropriations for new bases. That the Army and Navy should be considered separately is, of course, obvious.

Planes for the Air Corps

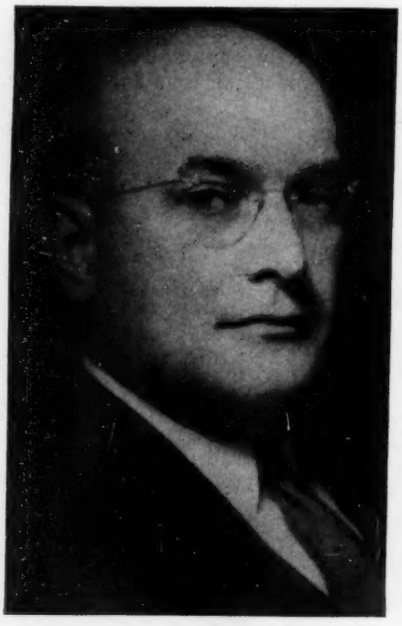
Perhaps the most spectacular single piece of legislation in the entire affair is the bill, known as H.R. 3791, to authorize the increase of the Air Corps' plane strength. As we go to press, slightly different versions have been passed by the House and the Senate by overwhelming majority votes in both cases. A conference committee of the two houses has just put the finishing touches on a compromise version which is almost certain to win quick approval from both chambers. The most important provision in it specifies that "the Secretary of War is hereby authorized to equip and maintain the Air Corps with not to exceed six thousand servicible airplanes . . . In order to maintain the number specified above the Secretary of War is hereby authorized to replace obsolete or unserviceable aircraft from time to time . . . and provided further that the total number of airplanes authorized in this section shall include the number necessary for . . . the National Guard and . . . the Organized Reserve," As will be described later, this act also goes into considerable detail in providing for an adequate increase in both the commissioned and enlisted strength of the Corps. It also carries authority for the "educational orders" for various military supplies as requested by the President.

Of utmost importance to the Aircraft Industry are these conference-added provisions: That contractors for aircraft under the act shall be limited to 12 per cent profits but that they shall be allowed to deduct any losses suffered in Army contract work over a four year period in computing such profits. That the War Department is authorized to purchase second, third and fourth ranking planes submitted in any design competition on a basis of 75 per cent, 60 per cent and 50 per cent respectively of the price bid for the first of each type. It does not necessarily have to do so however. There are no special labor requirements included beyond those attached to any governmental contract.

It must be understood that H.R. 3791 is solely an act of *authorization* which was necessary to permit the Air Corp to exceed the former goal of 2,320 previously set for it on the recommendation of the Baker Board. Like many another congressional act. it means only as much as Congress chooses to make it mean through appropriation of funds.

Money for the planes

In this case it seems apparent that Congress has every intention of following through with the money. The $50,000,000 asked by the President to start the plane program has been placed in the Second Deficiency Appropriation Bill which is expected up for vote during the early days of April. Other parts of the total of $300,000,000 suggested by F.D.R. as the cost of the air corp increase will



Ass't Sec'y Louis A. Johnson

Maj. Gen. Henry H. Arnold

International

Ass't Sec'y Charles Edison

On the shoulders of these four men, has rested the burden of shaping complex programs for increasing our air defenses—and

International

Typical of the brilliant new plane types submitted for the Army's choice is this six-mile-a-minute light bomber by Martin.

Left: Typical of new Air Corps facilities in this new Sacramento Supply Depot.

Rear Adm'l Arthur B. Cook

of selling those programs to Congress.

be made from time to time, presumably as requested. Right here, it is important to straighten out one source of common misunderstanding. In the President's message the $300,000,000 was ticketed "for the purchase of . . . airplanes." What the President really meant, it turns out, was $170,000,000 for new planes, engines, instruments and spares and $130,000,000 to train and pay the required additional personnel; to construct new hangars and field facilities for them; and to increase the research and testing facilities of Wright Field in Dayton.

Another thing that must be understood is that the $300,000,000 program is intended to represent an *increase* over the Corps present program to have 2,320 planes by July 1st, 1940. To carry out the normal procurement for that purpose and to take care of any obsolescence or crashes during the interim, the regular Military Establishment Appropriation Bill for 1940 carries an item of $20,340,700. Complete funds for all other expenses of the "unincreased" Air Corps are of course also included. So far this 1940 Bill has been passed only by the House. Senate approval without important change can however be counted upon.

The exact plans which the air corp has prepared for it's procurement program under the enlarged authority have, of course, not yet been announced. For $170,000,000, it expects to get at least 3,032 planes, and it expects to receive deliveries on them "within 18 months to two years." With the exception perhaps of training planes, it intends to let contracts only for ultra-modern types. It feels it has such models available in all save one or two catagories for which competitions have been ordered within the near future. According to Assistant Secretary of War, Louis A. Johnson, the Corps has already decided, on the basis of recent competitions, in just what numbers and to just what contractors it intends to award the great bulk of its orders. And it will place these contracts within a very short time of its receipt of news that Congress has appropriated that initial $50,000,000.

Other fragments of interest to the industry: Any idea which the Administration might have had last year of establishing nationalized factory units of any kind are now completely shelved . . . Reports that the Air Corps would bring great pressure upon airplane factories now located in coastal regions to move "inside the mountain ranges" can be put away and forgotten—the War Department would naturally like to have any new factory projects "consider" vulnerability to bombing raids in choosing a site, but

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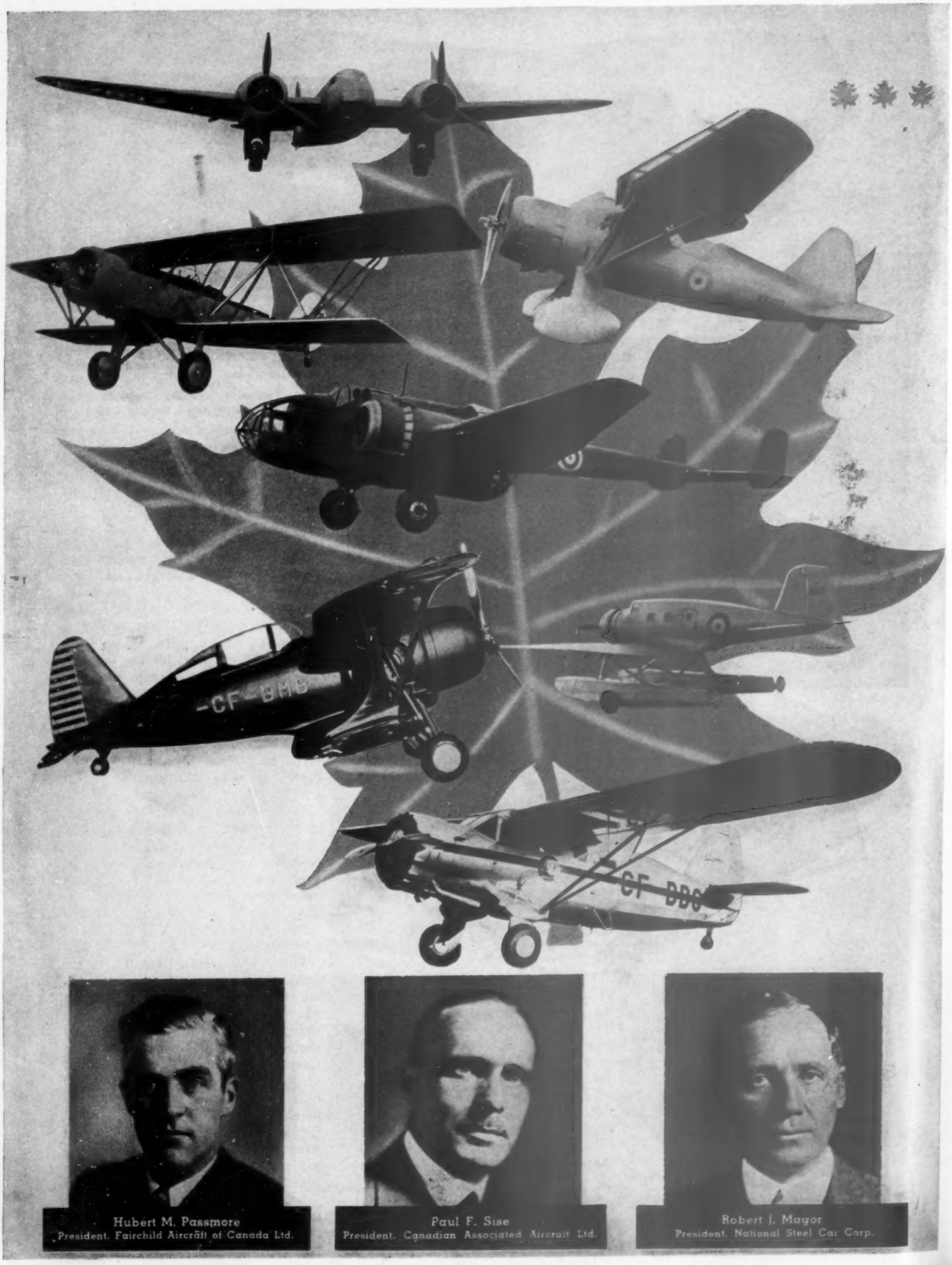


Hubert M. Passmore
President, Fairchild Aircraft of Canada Ltd.

Paul F. Sise
President, Canadian Associated Aircraft Ltd.

Robert J. Magor
President, National Steel Car Corp.

GROOMING

Canada's Aircraft Industry

Trial orders on the books, with prospects of substantial quantities to come, are lifting Canadian aviation from the doldrums.

By James Montagnes

THE CANADIAN AIRCRAFT INDUSTRY is being groomed to become once again an important source of supply for Great Britain in case of a European war. Once before the mother country relied on Canada to supply the wings of war. During the World War hurriedly assembled airplane manufacturing plants at Toronto produced 2,900 two place fighters for European war zones. This summer practically every one of the 10 Canadian airplane manufacturing companies will be starting production of entire or parts of military airplanes for the British Air Ministry and the Royal Canadian Air Force.

In the summer of 1938 a British Air Mission toured Canada and conferred with aircraft manufacturers, financiers and the Canadian government. As a result initial orders have been placed with individual companies and with a specially formed syndicate for the production of fighting airplanes to ascertain how speedily the Canadian aircraft industry can build military machines. If production this year and next comes up to expectations, orders for more advanced airplanes are expected.

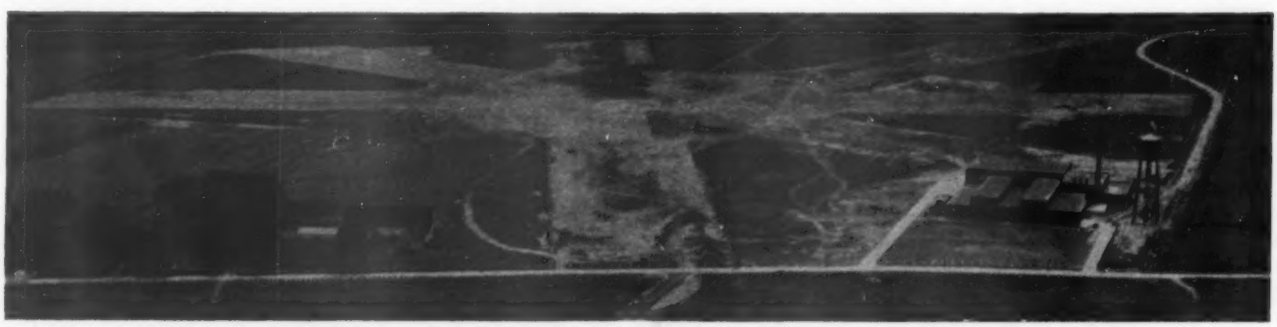
This spring two new 100,000 sq.ft. aircraft assembly plants were started at Toronto and at Montreal. Each is about the same as the recently completed plant of the National Steel Car Corporation at Toronto's Malton airport, covering 60,000 sq.ft. in the main building and 4,800 sq.ft. in the adjoining dope plant and power house. These two new assembly plants are being built for occupancy this autumn by Canadian Associated Aircraft Ltd., Montreal, a central assembly company formed by leading Canadian bankers and six aircraft manufacturers to handle the orders of the British Air Ministry. Colonel Lewis C. Ord, Toronto born engineer, has been brought from England to be general manager of the Canadian Associated Aircraft Ltd. He is credited with the introduction of mass production development in the British aircraft industry, has been many years in England as a railroad car builder and railway executive.

Initial order for the central organization is an undisclosed number of Handley Page Hampden bombers. Because it is against British Air Ministry regulations to talk about the exact number of planes ordered or their value, officials of the central organization would not reveal the size of the order. Unofficial estimates place it at 100 bombers, at a total cost including plant equipment and organization cost of more than $10,000,000. Eighty men will be required at each of the Montreal and Toronto central assembly plants to put the machines together, according to an official estimate. The six factories which will build parts will employ about 2,200 men.

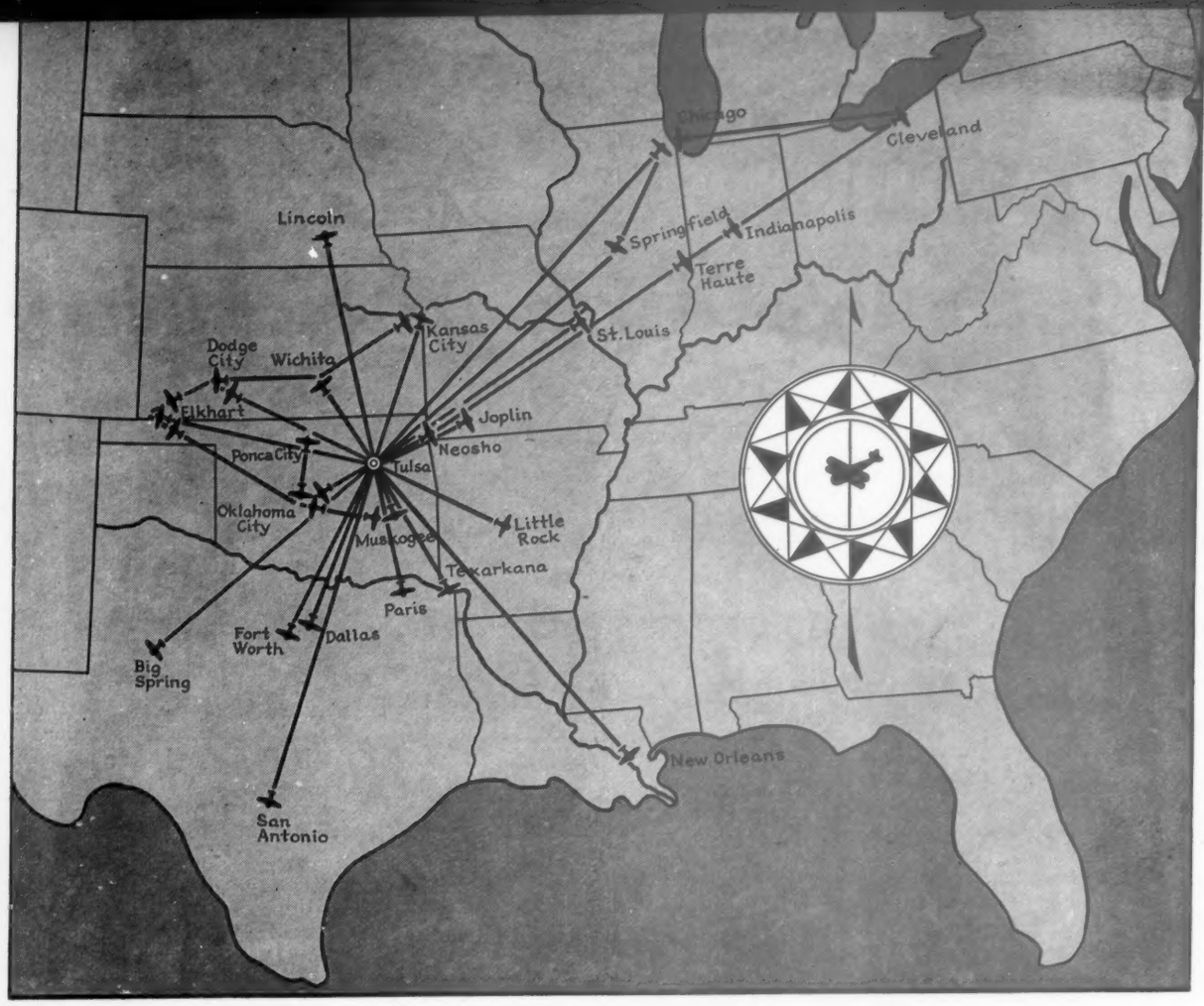
The central assembly set-up allows (1) for parts to be produced for the Toronto assembly plant at Malton airport by the Ottawa Car Manufacturing Co. Ltd., Ottawa; Fleet Aircraft of Canada Ltd., Fort Erie, Ont.; and by National Steel Car Corporation, Toronto; (2) parts for the Montreal assembly plant at St. Hubert airport by Fairchild Aircraft Ltd., Longueuil, Que.; Canadian Car & Foundry Co., Lt., Montreal; Canadian Vickers Ltd., Montreal; (3) airplane engines and armaments to come from England supplied by the British Air Ministry for installation in Canada; (4) the completed tested bombers to be flown across the Atlantic by easy stages during the late summer of 1940, though this question has not yet been definitely decided.

Financially the central assembly setup is a private corporation, reportedly

(Turn to page 83)



Extensions will be made this year to the Fairchild plant at Longueil, near Montreal.



Around the Compass with THE DAWN PATROL

A million miles of student cross-country flying

By Jess D. Green

Director Spartan School of Aeronautics
"Home of the Dawn Patrol"

TEN AIRPLANES are lined up on a concrete apron, engines warming up with a muffled roar. Thirty young men and women in flying suits, helmets and goggles, maps in their hands, are grouped around the flight leader for last-minute instructions. Then they dash to their places in the planes. Three biplanes pull out of line, maneuver into position in a vee formation and take off. Behind them comes another vee formation of biplanes, and behind that a formation of two biplanes headed by a low-wing monoplane. Then the tenth plane, a four place cabin monoplane in which a radio operator is calling the local airways radio station and giving the PX information on the flight, takes off and follows the group like a mother hen herding her chicks.

It's another cross-country flight of the Dawn Patrol, students from the Spartan School of Aeronautics, Tulsa, Oklahoma. Perhaps they are headed for Fort Worth to take part in the Aviation Day activities of the Frontier Fiesta. Perhaps they are to land at Neosho, Missouri, as guests of the city during the annual Harvest Festival, where they will give exhibitions of aerobatics and formation maneuvers. Or their destination may be Paris, Texas, where the Dawn Patrol is welcomed each year on Armistice Day for the local program. Or they may be on their way to join the Oklahoma State Air Tour, visiting every important airport in the state over a four-day period. San Antonio, Chicago, St. Louis, Gainesville, Dallas, Randolph Field, Cleveland, Texarkana, Wichita, and a score

of other cities in Oklahoma, Texas, Arkansas, Missouri, Kansas and other states, all have welcomed the wings of the Dawn Patrol as the students of Spartan School of Aeronautics have piled up more than a million miles of cross-country flying during the past three years alone.

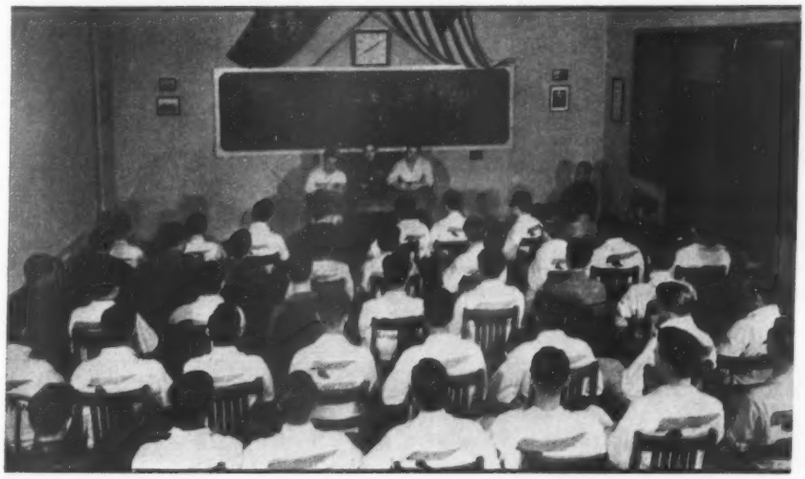
At their destination the planes will land in formation, line up in a row, and be staked down carefully, engines and cockpits covered by the student pilots and mechanics. Official hosts will carry the party off to town where they will be entertained at lunch or dinner, at a dance or carnival. Perhaps the occasion calls for the Dawn Patrol to perform formation maneuvers during an airport dedication, perhaps they take part in amateur races and contests at a local air meet, perhaps they drop flowers during a memorial program, or participate in a serious industry conference, but in any case they are playing a vital part in the current aviation picture and they enter into the activity with enthusiasm.

The Dawn Patrol is actually older than its name. In 1928, during the early days of the Spartan school, three enthusiastic advance flight students, proud of their aerial skill and achievements, decided to call themselves "The Three Blind Mice." They painted appropriate insignia on their training planes and were the first of the Spartan students to practise formation flying and other maneuvers together. Naturally competition soon developed among their classmates and rival trios appeared, called variously, "Three Aces", "Three Diamonds", "The Shamrocks", Three Kiwis", etc. These groups made the first cross-country student flights from the Spartan school, attracting considerable attention with their names and insignia.

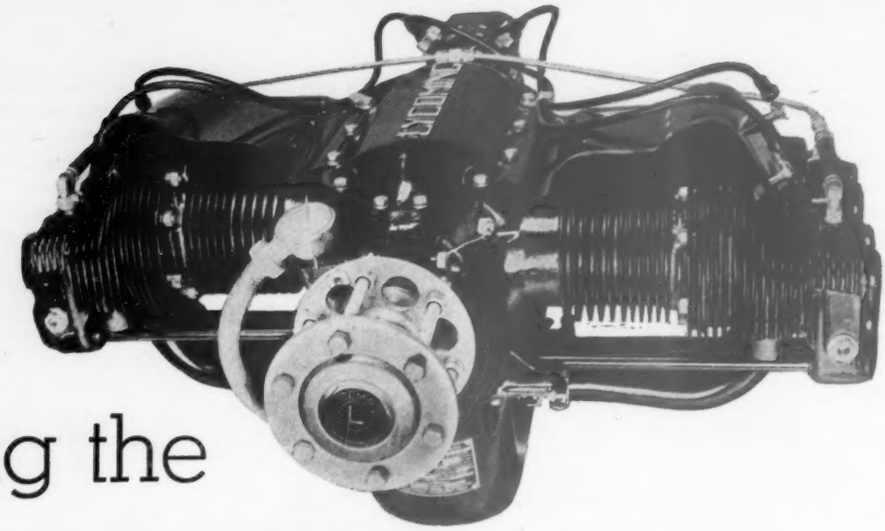
When the Army's new training center at Randolph Field, Texas, was dedicated we grouped all these teams together in a fifteen-plane formation which flew over the field in a large "A" formation. We called this group, the only commercial school represented on that occasion, the "Spartan Legion". A rather elaborate motion picture in color was made in 1929 describing the activities of the "Spartan Legion" and of every phase of flight training at the Spartan school. About this time a film was produced in Hollywood called "The Dawn Patrol" and this name was immediately adopted at Spartan as more appropriate than the "Legion", especially as it has always been the custom of Spartan students to make their training flights at dawn. Since that time the students at Spartan have been "The Spartan Dawn Patrol" and

(*Turn to page 80*)

Jesse D. Green, Director, conducts a meeting of those who supervise work of the Dawn Patrol.

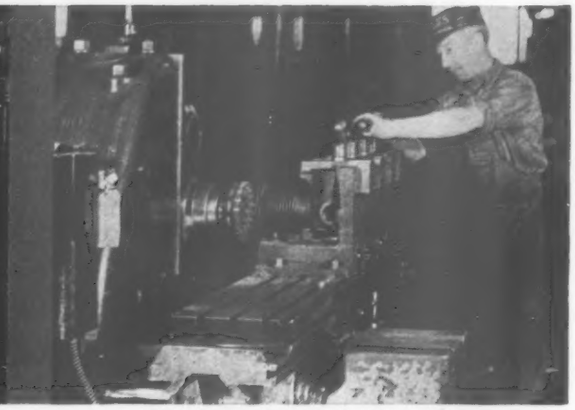


Above: A meeting of the participants in the dawn patrol. Below: Just before the start of a cross-country flight.

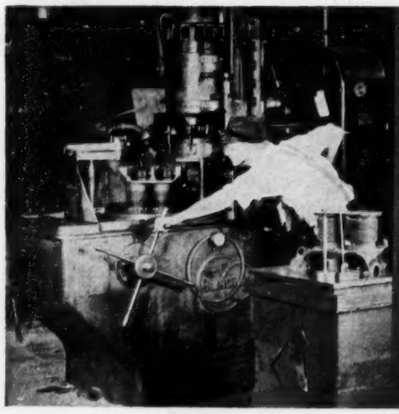


Building the LYCOMING 50

A semi-steel electric furnace casting is used in the two halves of the crankcase. After castings have been cleaned and painted the two halves go to the milling department. The milling machine shown in the foreground mills the parting joints on the two halves by the use of two special fixtures one for each half mounted on an indexing plate.

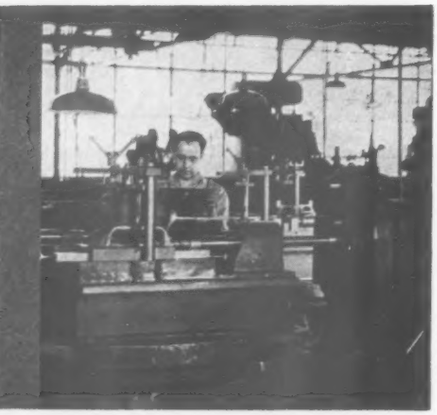


On the next operation cylinder head contact sides are milled as shown in illustration, a fixture holding right and left halves at the same time. The machine shown is made by the Cincinnati Milling Machine Company, Cincinnati, Ohio.



The cylinder contact sides are then ground on a Blanchard grinder. This operation removes all spring due to clamping in the milling operations and insures flat surfaces on contact faces.

Barrels are bored. A standard machine bores the right and left cases simultaneously. A rough and a finish cut are taken. A Moline boring machine is used.



The main and cam bearings are then bored on a Rockford drill. Two fixtures, one for the right case and one for the left, are installed on an indexing table. One is bored while the other is loaded.

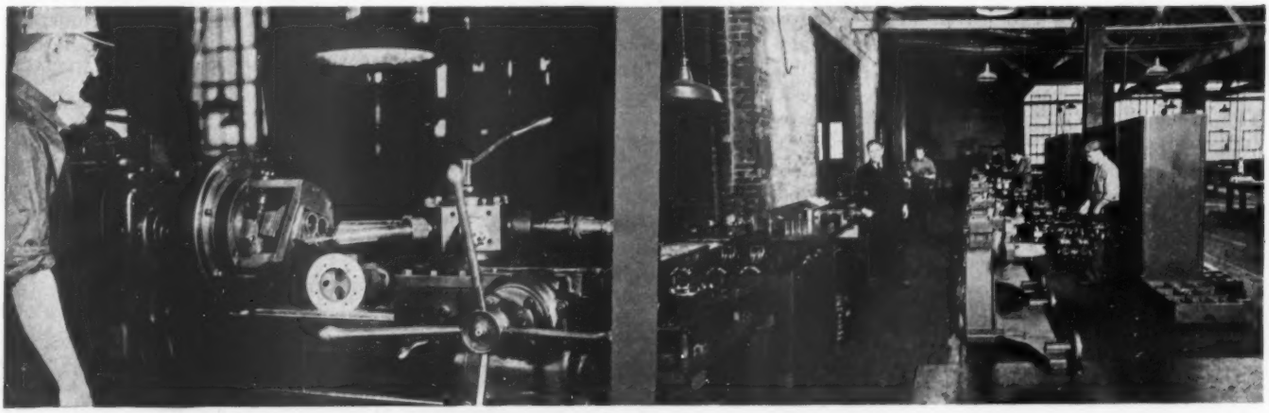
The next four drilling operations (right to left): Stud holes in cylinder head contact face. Cover contact side. Oil sump side. Rear end. On the latter three operations fixtures permit drilling right and left case simultaneously.

Here three important operations are performed on the cylinder barrels of the Lycoming 50. At the left, a Baker reamer is used in finishing the barrels. In the center, the top of the barrels are counterbored using a drill press made by the Barnes Drill Company. At the right, barrels are lapped using a lap made by the Moline Tool Company.

In the illustration, the crank and cam holes are line reamed using a Rockford Universal boring mill, and the oil seal diameter is reamed and the thrust bearings faced using an Aurora drill press.

Connecting rod bearings on crankshaft are turned on two machines, one machine turning Nos. 1 and 4 bearings and the other Nos. 2 and 3 bearings. Wicks lathes are used.

Main and crankshaft bearings are ground to a precision tolerance and finish using grinders made by the Norton Machine Tool Company, Worcester, Mass.



Most important operation on the cylinder head,—the drilling, boring, and reaming of valve guide holes and valve insert counterbores. This operation must be performed with the greatest of care. It is done on a turret lathe made by the Warner-Swasey Company of Cleveland, O.

The Lycoming O-145 is then assembled. At the left is a tank where cylinder heads are heated in hot oil for the inserting of studs. Sub-assemblies are made up on the benches on the left. The bins on the right contain the finished material which is readily accessible for assembly into the engine.

Courtesy Solar Aircraft Co.

Exhaust manifold for P & W twin-row engine. Note Solar type expansion joints between each section of the main collector ring and on long cylinder elbows. Fig. 4.

Stacks and Rings

The design and installation of exhaust manifolds and their accessories

Part I—Collector Rings

By George F. Titterton

Executive Engineer, Grumman Aircraft Engineering Corp.

THE DESIGN and manufacture of exhaust collectors, or manifolds, is becoming daily more difficult as engines developing 1800 horsepower and more become available for use. The unfailing dissipation of the heat and gases which are by-products of this enormous power is the primary function of an exhaust system. In doing its job the exhaust system must not be permitted to absorb any of the hard-earned engine power. Furthermore it must be light, rugged, and trouble free. The design of an exhaust system to meet these and numerous minor requirements is a job that calls for highly specialized engineering skill and experience.

The following points must be considered by the designer when developing the exhaust system for a new installation:

The cross-sectional area of the collector must be sufficient to permit rapid discharge of the exhaust gases without creating back pressure. Back pressure in the exhaust system prevents satisfactory scavenging of the burnt gases in the cylinder and results in loss of power. An acceptable exhaust system may have an average back pressure on all cylinders not exceeding 6 inches of water (.217 lbs./sq. in.). The back pressure of any one cylinder may exceed this figure providing it is not greater than 9 inches of water (.315 lbs./sq. in.). Although the amount of back pressure is primarily a function of the cross-sectional area of the collector it is also affected by the flow path of the exhaust gases. This point will be considered in detail under the subheading "Shape and Location".

The cross-sectional area required in any exhaust collector is a function of the power output of the engine. An empirical formula commonly used for computing the cross-sectional area is as follows:

$$A = (.04\ (P)\ \frac{n}{N}$$

where

A = minimum cross-sectional area required at any section.
P = maximum horsepower of the engine.
n = number of cylinders exhausting into the section under consideration.
N = total number of cylinders of the engine.

This formula gives the area required at any point along the collector. The area depends upon the number of

cylinders that have exhausted into the main collector at the section under consideration. In the interest of minimum weight and uniform gas flow it is advisable to increase the cross-sectional area of the collector as the discharge of each cylinder or pair of cylinders enters the main ring. When the collector is fabricated from sheet material it is customary to increase the cross-sectional area uniformly throughout its length. In the above formula the term Pn/N represents the fractional part of the total horsepower that must be handled by the section being designed. The required cross-sectional area in square inches is .04 times this fractional horsepower. When tubing is used in fabricating a collector a standard size tube of sufficient area must be selected for each section of the collector.

Courtesy Grumman Aircraft Engine Corp.

Fig. 1. Exhaust Manifold for Wright Cyclone R-1820-G5 engine. Note cowling well or shroud formed around collector ring when side cowling is installed. Heated air from shroud is led to down draft carburetor at top. Note also the connections for the sampling and exhaust lines for the fuel-air mixture ratio analyzer.

As indicated above all exhaust collectors increase in cross-sectional area as additional cylinders discharge into the main ring. In single-row radial engines of 5, 7, or 9 cylinders the main ring is increased in diameter, and area, between each cylinder. In twin-row engines such as the 14 cylinder type which is now so common it is customary to increase the size of the main ring every 2 cylinders.

TABLE 1

Exhaust Tubing Capacity & Weight

Size	Area Sq. In.	Hp. Cap.	Weight Per 100 In. S.A.E. 1025	18-8	Inconel
1½ x .035	1.60	40	4.56	4.57	4.98
.042	1.57		5.41	5.43	5.91
.049	1.54		6.33	6.35	6.91
1¾ x .035	2.22	55	5.34	5.36	5.83
.042	2.18		6.14	6.43	7.00
.049	2.14		7.42	7.44	8.10
2 x .035	2.92	73	6.12	6.14	6.68
.042	2.88		7.33	7.35	8.00
.049	2.84		8.5	8.53	9.28
2⅛ x .035	3.30	82	6.50	6.52	7.10
.042	3.25		7.75	7.78	8.46
.049	3.20		9.08	9.11	9.91
2¼ x .035	3.73	93	6.91	6.93	7.54
.042	3.68		8.25	8.28	9.01
.049	3.63		9.60	9.63	10.48
2⅜ x .035	4.15	104	7.23	7.25	7.89
.042	4.10		8.66	8.69	9.46
.049	4.05		10.14	10.17	11.07
2½ x .035	4.64	116	7.66	7.69	8.36
.042	4.58		9.16	9.19	10.00
.049	4.52		10.69	10.73	11.67
2⅝ x .035	5.11	128	8.08	8.11	8.82
.042	5.05		9.66	9.69	10.55
.049	4.99		11.24	11.28	12.27
2¾ x .035	5.64	141	8.41	8.44	9.18
.042	5.58		10.08	10.11	11.00
.049	5.52		11.78	11.82	12.86
3 x .035	6.74	168	9.24	9.27	10.09
.042	6.67		11.08	11.12	12.10
.049	6.60		12.86	12.90	14.04
3¼ x .035	7.94	199	10.00	10.03	10.92
.042	7.87		11.99	12.03	13.09
.049	7.80		13.95	14.00	15.23
3½ x .035	9.24	231	10.74	10.78	11.73
.042	9.16		12.91	12.95	14.10
.049	9.08		14.99	15.04	16.37
3¾ x .035	10.64	266	11.58	11.62	12.64
.042	10.55		13.83	13.88	15.10
.049	10.46		16.16	16.22	17.65
4 x .035	12.13	303	12.33	12.37	13.46
.042	12.04		14.83	14.88	16.19
.049	11.95		17.24	17.30	18.83
4¼ x .035	13.72	343	13.30	13.35	14.52
.042	13.62		16.13	16.19	17.61
.049	13.52		18.96	19.03	20.70
4½ x .035	15.41	385	13.87	13.92	15.15
.042	15.31		16.70	16.76	18.24
.049	15.21		19.53	19.60	21.33
4¾ x .035	17.20	430	14.72	14.77	16.07
.042	17.09		17.83	17.89	19.47
.049	16.98		20.94	21.01	22.87
5 x .035	19.08	477	15.56	15.61	16.99
.042	18.97		18.68	18.74	20.40
.049	18.86		21.51	21.58	23.49

This avoids too many step-ups in size and joints in the main ring. One important reason for stepping-up the size between each cylinder of single-row engines is to obtain a flexible joint that will expand in conformity with the 2 cylinders it joins, as the engine gets hot. In twin-row engines the 2 cylinders led into a common section of the collector ring are taken 1 from the front bank and 1 from the rear bank of cylinders. By this means the expansion differential between the 2 cylinders is greatly reduced which makes it practical to join these cylinders in one section of collector ring. No expansion joint is necessary between two such cylinders. The area of any section of collector ring joining 2 cylinders must, of course, be based on the total fractional horsepower of both cylinders, plus the cylinders already led into the collector.

For purposes of illustrating the computation of exhaust collector areas the collector shown in Fig. 1 will be selected. This collector was designed for a 9-cylinder, Wright "G" Cyclone developing 1000 horsepower for take-off.

Each cylinder develops 1000/9 = 111 horsepower.

The required area for the 1st cylinder; is 111x.04. = 4.44 sq. in.; for 2 cylinders, 4.44x2 = 8.88 sq. in.; for 3 cylinders, 4.44x3 = 13.32 sq. in.; for 4 cylinders, 4.44x4 = 17.76 sq.in.; for 5 cylinders, 4.44x5 = 22.20 sq.in. The exhaust collector shown in Fig. 1

(Turn to page 79)

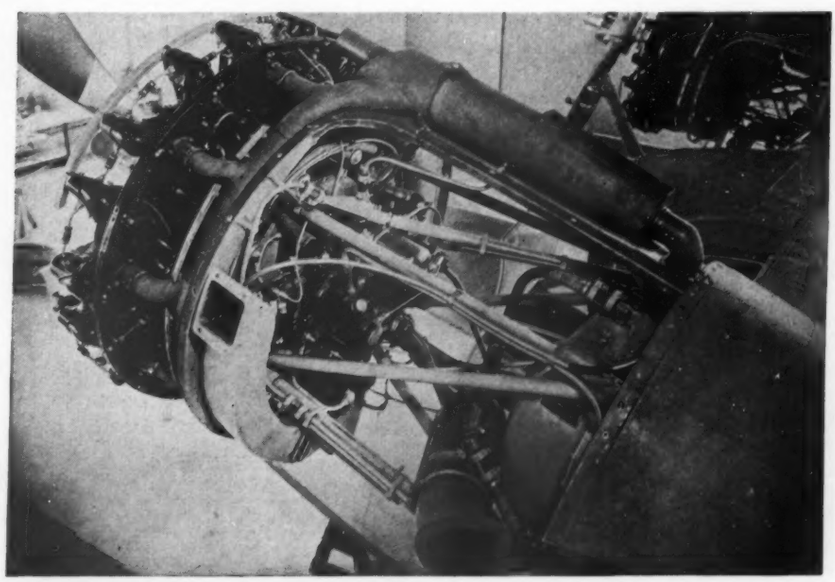
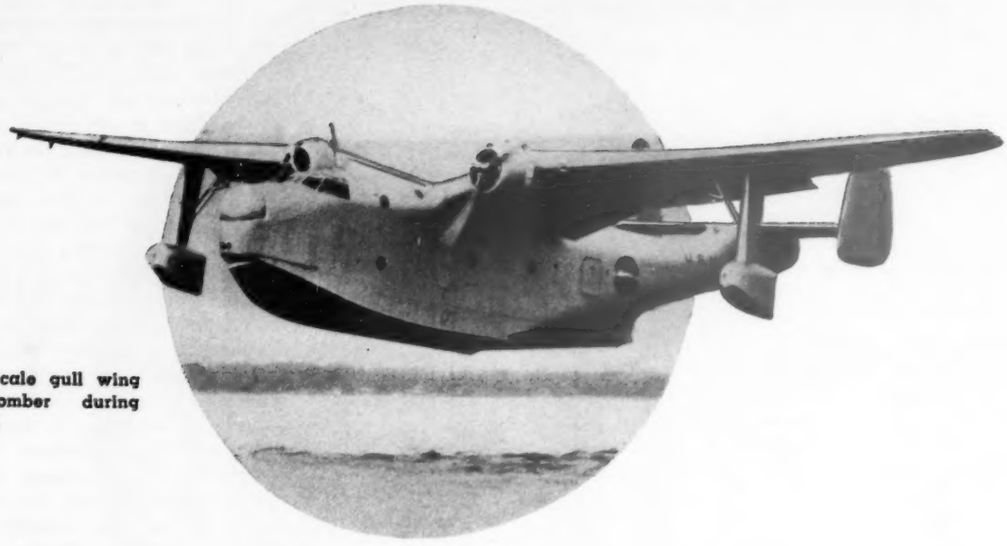


Fig. 2. Exhaust manifold for P & W Wasp, Jr. engine. Note exhaust outlet above nacelle is hidden from pilot's and passengers' view. Note also cabin heater pipe led through exhaust outlet extension.



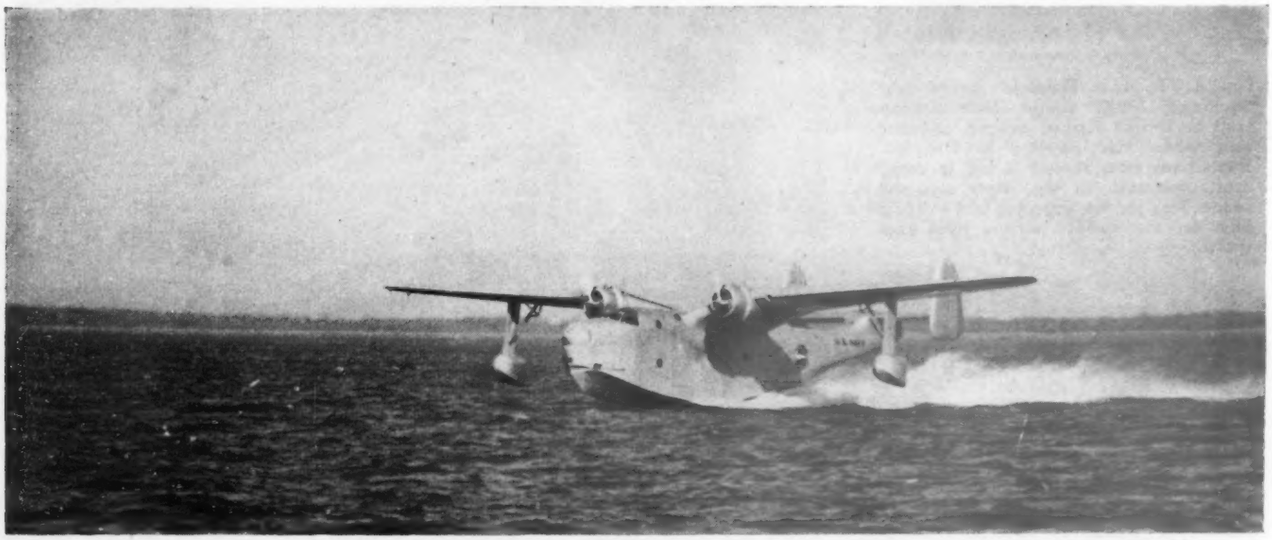
The full scale gull wing patrol bomber during flight tests

MARTIN 162

18 ton Navy Boat Completed Following Preliminary Tests on Quarter-Scale Flying Model.

IT COSTS a lot of money to make changes in the design and construction of large aircraft after they are built and, while the changes are being made overhead marches on. With this in mind the farsighted engineers of the Glenn L. Martin Company decided to build a quarter-scale flying model of the XPBM-1 before they built the ship full size. The small-scale ship was built and tested in 1937 and the engineering staff learned a lot about its performance and other characteristics before the factory started to work on the ship. Now the 18 ton patrol bomber has been built and is being tested at Baltimore before delivery to the Navy.

The new Martin flying boat is a twin-motored gull winged monoplane having a wing span of 118 ft. and an overall length of 78 ft., powered with



Intensive testing of the handling characteristics on the water was an important part of the trial program for the Martin 162

double-bank engines of high horsepower rating.

The distinctive feature of the ship's outward appearance is the "gull-shape" of its wings, which curve upward from the hull in graceful lines. The wing design was developed to secure maximum propeller clearance above water during taxiing, taking off and landing, the engines being carried higher above water-line by its means than is practical with flat-wing models.

The ship, designated the XPBM-1 by the Navy and Model 162 by the manufacturers is known to provide for a crew of seven, with at least three assigned to spherical gun-turrets, one in the bow and two amidships on either side of the hull.

Other identifiable details include retractable floats under the wings and a hull sufficiently broad in the beam to afford generous working areas and passage space between compartments and complete living quarters for the crew. No disclosures have been made as to speed, flying range, or armament details.

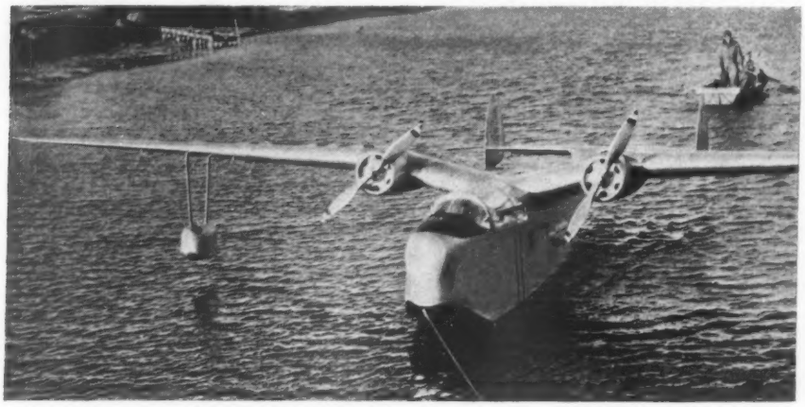
Immediately following first tests under full load of the new flying ship, President Martin made the following statement:

"It was not only gratifying, but quite important to the executives of this company that during the rigid water-stability-tests and maneuverability tests on water, as well on takeoff and landing, the new boat exhibited the identical characteristics recorded during the series of tests previously conducted by the one-quarter scale man-carrying flying model.

"We believe that in flying a man-carrying model, in addition to building the usual wind tunnel models and towing basin models for this project, this company once more pioneered and made an important contribution to the engineering and development methods used in the design and construction of important large airplane projects.

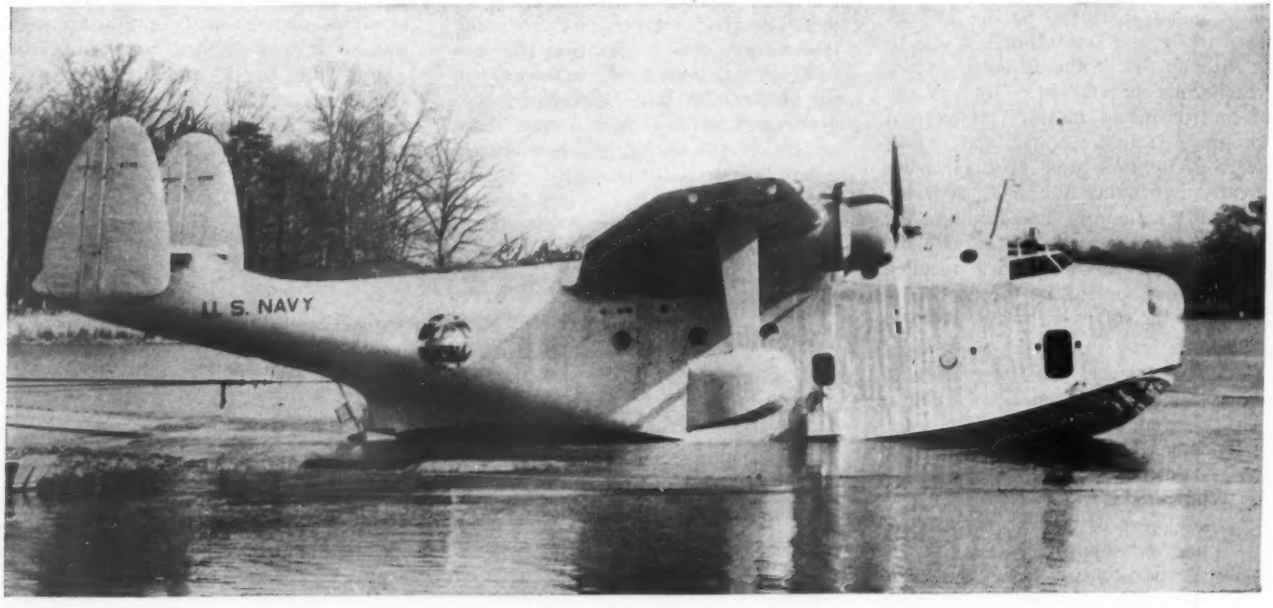
"Obviously the construction and testing of small scale flying models is an expensive undertaking. However, with today's records available for study, we realize that we need never have any hesitation in placing complete reliance in the performance statistics and characteristics demonstrated by a small scale prototype. Tests of the 162 have furnished a complete confirmation of the earlier tests of the flying model."

Experts present during the trials of the patrol bomber admired the marked advance in hull lines, as well as the highly satisfactory aerodynamic characteristics. At no time did the boat exhibit even the slightest tendency towards porpoise. The plane was landed "down" a twenty-one mile an hour wind without the slightest porpoise or defect in landing characteristics.



This quarter-scale, flyable, man-carrying prototype of the new Martin Patrol Bomber when flown in 1937 accurately foretold the handling characteristics of the new full-sized boat launched in February of this year

Flying Equipment



The XPBM-1 at rest between flight and water operation tests

Developing the ERCO Airplane

By Fred E. Weick

Chief Engineer
Engineering and Research Corp.

ABOUT EIGHT YEARS AGO a small group of engineers employed at the laboratories of the N.A.C.A. undertook a private study to explore the possibilities of developing the airplane to be more suitable for general private use. The study included many computations, tests on fiying models, and the construction, testing, and modification of the W-1 experimental airplane. The results of this work were published in two previous articles in the July, 1934, and January, 1936, issues of AVIATION.

During the past two years a two-place airplane, intended for the private commercial market, has been constructed by the Engineering & Research Corporation, due to the interest of its president, Henry A. Berliner, in the flight characteristics that resulted from the W-1 airplane development. The present Engineering & Research Corporation or Erco plane incorporates many of the features found in the previous study, and the present article will bring the account up to date.

The main features in the W-1 and the modified W-1A that were intended to be more attractive to the private user were first, that the airplane was to be much easier to handle and to learn to fly, and second, that it was to be safer in that it should be free from treacherous characteristics such as loss of control due to stalling, inadvertent spinning, ground looping, and nosing over. Attention was also given to greatly improving the field of view, especially in landing and taxiing.

The endeavor to obtain an airplane having these characteristics resulted in the development in the W-1 and W-1A of the following unconventional features:

A. The tricycle landing-gear with castering nose-wheel, steerable if desired.
B. Suitable longitudinal and lateral stability with definitely limited upward elevator travel to prevent loss of control due to stalling and spinning.
C. A glide-control flap.
D. Two-control operation using pitching and rolling controls.

Our conclusions following the various tests and trials, as stated in an S.A.E. paper, given in 1936, are repeated below:

> We feel that we have demonstrated to our own satisfaction that each of the features described is a help in making flying both simpler and safer.
>
> The stable long-travel, three-wheel landing-gear arrangement enables satisfactory landings to be made almost regardless of the wind direction, the air speed at contact, or the manner in which the airplane is flared at contact or guided to the ground.
>
> Freedom from the danger of stalling was obtained by having the longitudinal stability and the available elevator control so related that the airplane, or at least the outer portions of the wing, could not be stalled. As long as high-lift wings are used, it seems a basic condition that this relation must hold in any completely successful solution of the problem.
>
> The glide-control flap is very helpful in enabling an unskilled pilot to approach and to make contact at a desired point with greater accuracy than a good pilot with a conventional airplane. (Sufficient improvement in power-plant reliability may eliminate the necessity for extra controls of this nature.)
>
> With the W-1A and its stable landing gear, two-control operation using the elevator and slot-lip ailerons is quite satisfactory and sufficient for ordinary flying, including making sharp turns, holding a course in gusty air, and making take-offs and landings in all directions with respect to the wind, with straight or with curved approaches. It appears possible to us and we hope that the elimination of rudder control in the manner described may be a definite stride toward reducing the skill, training, practice, and general keenness required to fly safely.

We now feel that our conclusions regarding the tricycle gear have substantiated by its immediate subsequent use on the Hammond and Waterman airplanes and by its recent more or less general acceptance as a promising type. Two-control operation has also subsequently been used successfully in the Hammond and Waterman airplanes and in the Gwinn Aircar.

The W-1 and W-1A were purely experimental types designed to be especially suited to the problem of developing the characteristics desired. The high wing pusher arrangement was used, with the tail supported on two booms, and the planes were in no sense sleek looking or beautiful to the eye of the average beholder. The problem with the present Erco airplane was to produce a salable, low-powered airplane of good performance and attractive appearance that also incorporated the ease of handling and safety that had been developed in the previous experimental planes.

It is easier to obtain the latter characteristics in a pusher design, but in order to get low drag and good performance it seems necessary to locate a pusher propeller some distance from the engine, e.g., with the engine inside the fuselage and two propellers back of the wing, one on either side. This arrangement entails the solution of two rather difficult engineering problems, one being a satisfactory transmission between the engine and the propellers, and the other being the satisfactory cooling of an enclosed engine without aid from the slipstream. The tractor arrangement is free from both of these difficulties and is more conventional in appearance, and so it was decided to attempt to obtain all of the desired characteristics in a tractor. The work was started a little over two years ago. An experimental model was designed and built

Erco's Ancestor,—The Weick W1-A

The new ERCO plane

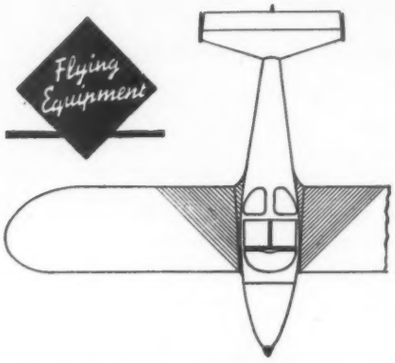


Diagram showing stalled portions of the wing

during the first few months; and during the past year and a half it has been subjected to a rather rigorous program of alternate testing and modification. The present appearance of the experimental prototype Erco plane is shown in the accompanying photographs.

Tricycle Landing Gear

The tricycle gear used is essentially the same as that of the W-1. The wheel base is somewhat smaller because the forward position of the nosewheel is limited by the tractor propeller, but we believe it to be ample for practical purposes. This belief is substantiated by one actual experience that occurred during the first flight trials. The front oleo strut was not yet functioning properly, in that it could compress only a small part of its total travel, and an extremely hard nose-down landing caused the front fork and oleo to bend back flat under the nose of the ship. The plane just slid to a stop on its nose and the two rear wheels with no apparent tendency to nose over, and nothing else was damaged.

The nosewheel is made to caster by sloping the fork forward and downward as in the W-1. It is also connected to the control wheel in the cockpit so that it is steerable. Several statements have appeared lately to the effect that it is preferable not to steer the nosewheel of a tricycle gear, but to allow it to caster freely and use differential braking to steer with, but I suspect that this thought has grown out of the difficulty of steering the nosewheel on large airplanes. In the case of the small plane the nosewheel is easy to turn and I decidedly prefer steering by means of it because it makes ground maneuvering very definite and very simple. In this matter there are several precedents supporting my stand; for automobiles, velocipedes, and even tricycles could have been steered by independently operated brakes if desired, but actually all of these vehicles are steered by turning the front wheels.

All in all, the tricycle gear on the Erco tractor has worked out very satisfactorily. Oleo shock absorbers are used that give the wheels one foot of vertical travel, and the airplane has made many exceedingly hard landings without damage. It has been landed at speeds all the way from the minimum to over 80 M.P.H. without showing any tendency to bounce off or leave the ground after the initial contact. That a delicate landing technique is not required has been shown by the fact that many landings have been made with all controls freed and the pilot's hands held up over his head after the approach had been substantially completed.

The photographs of the experimental model show its rear landing gear structure unfaired, but a streamlined fairing covering the supporting post and the telescoping oleo tube behind it are being provided on the production model. The front oleo fairing, which projects backward and upward when the airplane is on the ground, fits vertically at the rear of the oleo tube when the wheel drops down in flight.

The gear has operated satisfactorily under extremely muddy field conditions. Even in mud so soft that the low-pressure tired wheels sank down past the brake drums, a start from standstill could be made from any part of the field. Take-offs have been made from very soft and muddy fields although, of course, the ground runs were longer than usual. Landing, taking off, and taxiing under these conditions have been carried on satisfactorily with apparent freedom from any danger such as nosing over. A few days ago one of our company pilots, Robert Sanders, made a take-off in an extremely soft and muddy field with practically a full load. The take-off speed was noticeably retarded several times by shallow ponds of water, but the take-off was made in about double the usual length of run. The local C.A.A. Inspector stated at the time that the ground conditions were unsafe for conventional light airplanes, and no other airplanes were flying from the field on that day.

Under ordinary conditions the take-off run seems to be about the same as that of other planes of the same wing and power loadings. With zero wind or very slight cross winds, take-off ground runs have been measured varying from 270 ft. to about 600 ft., depending on the field conditions and the load. Under ordinary wind conditions the take-offs are, of course, substantially shorter.

Freedom from Stalling and Spinning

Briefly stated, the way to avoid stalling difficulties is to avoid stalling the wings, or at least their outer or tip portions. This can be done in the present conventional manner by rely-

(Turn to page 36)

EASTERN AIR LINES STEPS WITH THE NEW GOODRICH

NEW-TYPE BRAKE CONSTRUCTION ELIMINATES "GRABBING" TENDENCIES

A full circle of individually articulated brake blocks forced against the brake drum by the Goodrich *Expander Tube* is the secret of this brake's remarkably smooth control. Whether used on the 12-ton air giants of Eastern Air Lines or on the smallest plane made, the non-energizing action eliminates "grabbing" tendencies. And Goodrich E.T.* Brakes cut maintenance expense because they require less attention.

Eastern Air Lines Gets Smoother Landing—Smoother Stopping With New Tire and Brake Combination

THE long association between Eastern Air Lines and Goodrich, that began with the use of Goodrich Airplane Tires eleven years ago—that saw the early adoption of the Goodrich DE-ICER and many other Goodrich Aviation Products—has most recently seen the addition of the new Goodrich E.T.* Brakes. And once again Eastern Air Lines—winner of many a coveted safety award—demonstrates how completely it values every new development that will offer still more safety and comfort to passengers.

Since flying was in its infancy, Goodrich has made a specialty of applying rubber to the building and flying of planes. The outcome is that leading pilots, plane makers and air lines *on every continent* come to Goodrich . . . not only for tires, DE-ICERS and brakes, but for more than 40 other Goodrich Aviation Products for every size and type of plane. Get in touch now by air mail with Dept. 674, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information. Ask for a copy of "Goodrich In Aviation."

*EXPANDER TUBE

MORE THAN ONE MAN'S OPINION...

READ WHAT THESE EASTERN AIR LINES PILOTS SAY ABOUT GOODRICH E. T.* BRAKES AND GOODRICH AIRPLANE SILVERTOWNS

"The Goodrich Silvertown Tire is a smooth performer in itself. But when it's backed up with the smooth-stopping Goodrich Brakes, it's a top-notch combination for landing on all types of terrain." **Capt. C. R. Coleman**

"Thanks to the combination of Goodrich Silvertowns and the new Goodrich Expander Tube Brakes, the technique of smoother landing and stopping has taken a big step forward." **Capt. R. P. Hewitt**

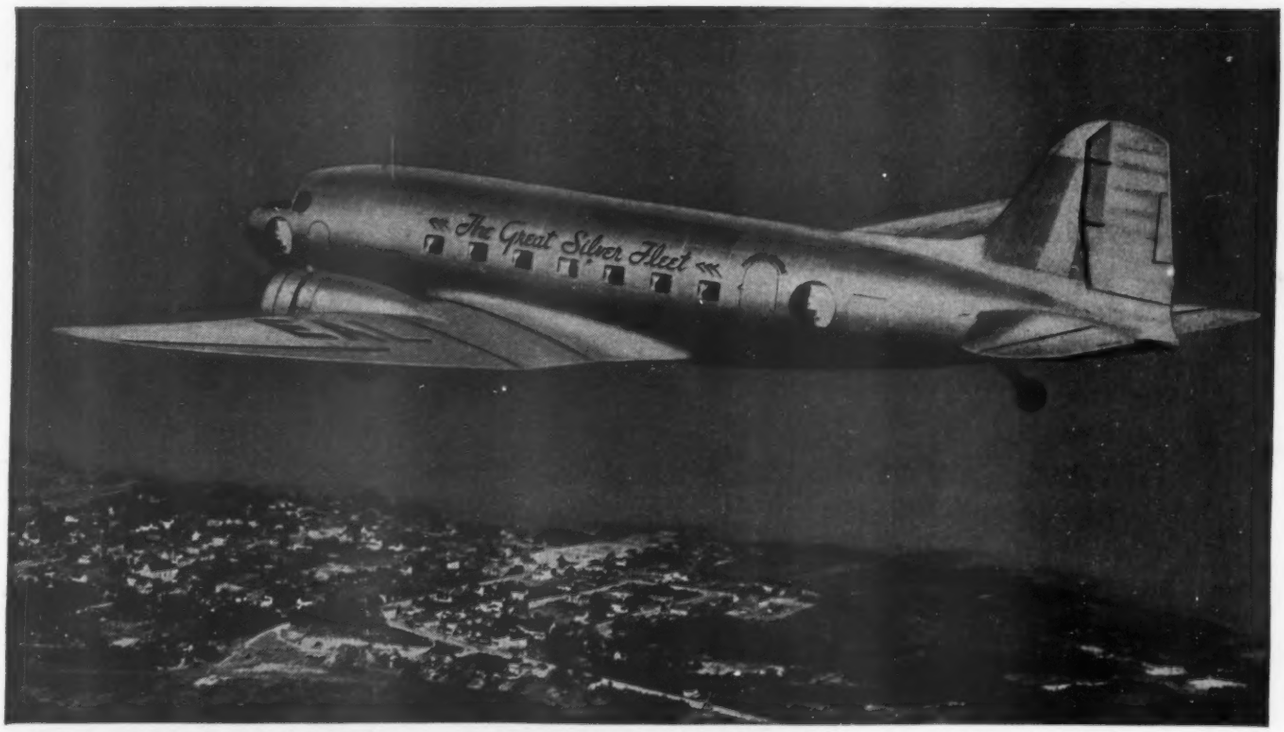
"Safe landings demand plenty of close teamwork between tires and brakes. Goodrich Airplane Silvertowns and the new Goodrich Brakes are certainly a team that works together to produce more safety and smoothness under all landing conditions." **Capt. J. B. Armstrong**

"The combination of Goodrich Silvertowns and Goodrich Brakes increases landing control under all conditions. Planes are decelerated to a smooth, uniform stop." **Capt. A. B. Duke**

"Goodrich Silvertowns with the new expander tube brakes give my passengers all the benefits and pleasure of smoother landing and stopping." **Capt. E. H. Parker**

"Stopping a plane with the new Goodrich Expander Tube Brakes gives a satisfying sense of safety and smoothness. It is the most uniform brake action I have experienced." **Capt. Gilbert Waller**

UP LANDING CONTROL E.T.* BRAKES AND TIRES



"NO TRESPASSING" FOR ICE. This Goodrich Wing DE-ICER being attached to an Eastern Air Lines plane protects every inch of the leading edge—cracking and breaking ice as fast as it forms. And, of course, to keep propellers clear of ice, Eastern Air Lines uses the Goodrich-developed "Spinner" and "Slinger Ring" Assembly.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — DE-ICERS — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.

(*Continued from page 33*)

ing on the pilot not to stall; but the doubtful success of the method is indicated by the accident records of the C.A.A., which show that of the fatal accidents that occurred in private flying during the past few years, more than two-thirds involved stalling or spinning. The stalling difficulty can also be avoided in a different manner by designing and building the airplane in such a way that it will not balance in steady flight at a high enough angle of attack so that the wings, or at least their outer portions, are stalled. In the W-1 this was accomplished by providing a longitudinally stable airplane and limiting the upward travel of the elevator surface. In the W-1A it was aided in addition by the slots of the slot-lip ailerons, which gave satisfactory control and stability but too great a drag to be used where performance is important.

In the present Erco design the use of the limited upward elevator travel is continued, and in addition the exact manner in which the wings approach the stalled condition has been carefully treated. A straight wing is used, the stalling of which naturally starts at the middle of the span. With the low wing monoplane arrangement used, the stalling or breaking away of the air flow is sure to start at the juncture with the fuselage if no fillet is used, and the air speed and angle of attack at which the breaking away of the flow starts can be controlled by proper filleting.

A series of different fillets was tried in flight tests that extended over a couple of months, the upper surfaces of the wing being covered with wool tufts to show the nature of the airflow. With the fillet finally selected, the flow starts burbling at the rear of the fillet when the speed of the airplane is reduced to a point a few miles per hour above the minimum speed, and the stalled portion gradually spreads as the speed is reduced until it includes the portion of the wing shown shaded on the accompanying figure. The outer portion of the wing does not stall even when the usual amount of maximum upward elevator is used, so that the stability and control are satisfactory in a glide with the control wheel full back even when the elevator travel is not limited below the conventional amount. Three factors contribute to the attainment of this condition. One is that the portion of the wing shown on the diagram stalls so definitely that the spanwise lift distribution is broken down in the center, and the outer panels act somewhat after the manner of two separate low aspect ratio airfoils, and can go up to a higher angle of attack before stalling. Another factor is that the pitching moment of the main wing changes as the center portion stalls in such a manner as to tend to decrease the angle of attack. Third, the loss of lift in the center of the wing reduces the downwash on the tail, thus reducing the effectiveness of the elevator in forcing the tail down and increasing the angle of attack. With all three of these factors at work, the usual amount of elevator control is insufficient to cause the outer portions of the wing, which in this case comprise most of it, to stall. Lateral stability and control are therefore maintained throughout the entire range of speed and angle of attack in gliding flight.

The burbled flow over the center section serves another useful purpose in that as the speeding glide is reduced to about five miles per hour above the minimum, a mild form of buffeting occurs which increases somewhat as the speed is further reduced. This automatically warns the pilot that he has little reserve speed or kinetic energy left for such purposes as overcoming the effect of gusts or flaring off of the flight path for landing.

The problem of avoiding stalling with power on entails additional difficulties in the case of a tractor airplane. In the W-1 pusher it was easy to place the thrust line of the propeller so as to give balance at the same speed, either in a glide with the throttle closed or in flight at any throttle setting, and so the same limited elevator position prevented stalling throughout the entire power range. With a conventional tractor arrangement, however, the slipstream passes over the center of the wing, increasing the downwash by a large amount. This added downwash increases the downward load on the tail and thus increases the angle of attack at which the airplane trims by a large amount of the order of 10° or more. On this account if the up travel of the elevator of a conventional tractor airplane is limited to the point where the airplane cannot be maintained in stalled flight with power full on, the plane will not fly at all with power off except in a very steep dive. Yet it is important to avoid stalling dangers with power on as well as in gliding flight, for a large proportion of all accidents involving stalls occur with power on. For example, of the accidents to light planes in 1937 attributed to stalling or spinning, only 10 per cent of the cases followed engine failure.

In order to obtain a satisfactory condition in this respect, the Erco tractor was arranged to have the propeller thrust give as large a nosing down moment as possible. The low wing arrangement and an inverted inline type engine help in this matter. With this arrangement the airplane trims at approximately the same speed for any constant elevator position at any throttle setting within the range of speeds ordinarily used in flight. Being a tractor, however, the propeller slipstream prevents the carefully worked out breaking-away of the flow at the center of the wing as the speed is decreased. In fact, the lift over the center portion, and therefore the downwash on the tail, is increased with power on and the airplane will fly at a lower speed than with power off. At the lowest speeds a single position of the elevator therefore gives a different airplane speed for each different throttle setting. The conventional amount of elevator control was sufficient to stall the wing with power on and for this reason a limitation to the up travel of the elevator was necessary. Flight tests showed that when the elevator up travel was restricted to a point at which the plane could not be maintained in stalled flight with power full on, it still had sufficient elevator control for all necessary flight maneuvers including taking off and landing.

One interesting and, I believe, important feature of the ship is that, when the control wheel is held full back and the power is full on, the ship does not sink in the usual stall, but will fly along in a slow unstalled climb with the nose up at an uncomfortably steep attitude. Of course, if the airplane has a reserve of speed to start with and the control wheel is suddenly pulled full back and held, the plane will whip up into a momentary stall, but it will not balance in the stalled state and so will immediately whip back out of it and into the unstalled range before there has been time for the wing to drop. This occurs whether power is used or not and even in a power-off whip-stall, the nose does not fall appreciably below the horizontal unless the stall is started from a very high speed.

Observations of the results of a large number of crashes lead to the conclusion that in the most serious ones the nose of the airplane has in practically every case come in contact with the ground at a rather steep downward angle. The airplane inherently moves rapidly in the direction toward which the nose points, but it

(*Turn to page 38*)

ARADO AR 79

TRAINING AND TOURING MACHINE

By a long distance flight over many countries, high mountains and vast oceans to Europe, Africa, Asia and Australia, the Ar 79 has again shown itself an ideal touring aeroplane. Included in the total distance covered was the 6,300 km. section Bengasi, (Libya), to Gaya, (India), flown non-stop in two nights and a day. This flight gained for the machine the speed record over 1,000 and 2,000 km. and the International long distance record*) for machines of this class. Comfort during flight, safety in operation, a petrol consumption of 10 to 11 litres at 100 km., and high performance, made possible the accomplishment of this flight across half the World according to schedule. These achievements also make the Ar 79, even in the most severe conditions, an independent means of transport for the private owner, — fast, comfortable, reliable and economical.

*) Sent to the F.A.I. for homologation.

Air touring limousine • Two seats side-by-side, comfortable cabin, excellent view, large baggage space • Retractable undercarriage, split flaps, dual control, suitable for aerobatics • 105 h.p. Hirth HM 504 A 2 motor • Maximum speed 230 km. h.

INTERNATIONAL LONG DISTANCE RECORD*

OBLT. PULKOWSKI † LT. JENETT

(*Continued from page 36*)

cannot move at high speed in a direction perpendicular to the wing surface. In our airplane we have tried to provide a combination of control and stability such that the plane is in no circumstances likely inadvertently to approach the ground with the nose down.

The limited elevator control not only insures stable and controllable flight conditions throughout the low speed flight range, but it prevents spinning as well. In addition to this precaution against spinning, we have designed the airplane in such a manner that it will not balance or trim in a spin. Besides the company pilots, Robert Sanders and Charlie Snyder, expert test and stunt pilots, including Melvin N. Gough of the N.A.C.A. staff, and V. W. Burnett, have attempted to force it to spin by means of all kinds of maneuvers, both power on and power off, some even in the inverted condition, but it has never shown any signs of entering a spin. And certain of these trials were made under extreme conditions with the full unrestricted elevator travel and with 20 lbs. of lead in the tail of the ship to make certain that it could be stalled.

Glide Approach to Landing

The gliding characteristics of our present ship are not quite so extreme as those of the W-1, but the glide is somewhat steeper than that of most conventional airplanes. In this ship we have relatively low power at the present time and cannot hope to get out of as small fields as the W-1 could. We are therefore not providing it with a flap, but are making it with the fewest possible number of controls to operate and the smallest number of things that the pilot must remember to do.

We find that we can get into a very small field by clearing the obstacles at minimum speed or close to it, and then nosing down and flying onto the ground at somewhat higher speed. With the tricycle gear and the ability to use the brakes, a short landing can be made in this manner.

Elimination of Rudder Control Pedals

In the flight trials of the W-1A it was found that two-control operation including taking-off and landing under all sorts of conditions could be carried out very well with the elevator and the slot-lip ailerons only, but the control with the elevators and rudders only was relatively unsatisfactory. In both cases successful handling in cross-wind landings depended on the ability of the tricycle gear in taxiing and running along the ground.

A theoretical analysis by R. T. Jones of the N.A.C.A. staff indicates that a turning control giving pure rolling moments and no yawing moments is close to the optimum for two-control operation, although a small and varying amount of yawing moment is required to produce perfect entries into and recoveries from turns with no trace of skidding or slipping. Ordinarily conventional ailerons can be used reasonably well, but the effect of their inherent adverse yawing moments must be overcome by the natural weathercock stability of the airplane, and a rather large amount of slipping and skidding in turns is likely to result. The use of conventional ailerons alone as the turning control in a two-control system has the disadvantage also that their effectiveness is likely to be lost as the stall is approached. The slot-lip aileron used on the W-1A had no yawing moments of any importance and they gave satisfactory control but as mentioned previously, their drag was excessive.

The present Erco plane is constructed in such a manner that the pilot can take his choice as to whether he flies it with two controls or with the conventional three controls. The system can be changed from the conventional three to the two-control arrangement in a few minutes, by adding a link connecting the ailerons and rudders together and removing the rudder pedals. Turning the control wheel then moves the ailerons, rudders, and nosewheel simultaneously, and turns the airplane whether it is flying in the air or rolling on the ground.

At first we had the nosewheel steered by the rudder pedals when the conventional three-control system was in use, but to our surprise even experienced pilots when taxiing would try to turn the airplane by turning the control wheel as in an automobile, even though it moved only the ailerons, and those in the opposite direction from that which they were trained to use to aid in making a turn on the ground. We are therefore providing for the nosewheel to be turned by the control wheel whether the two or the three-control arrangement is in use.

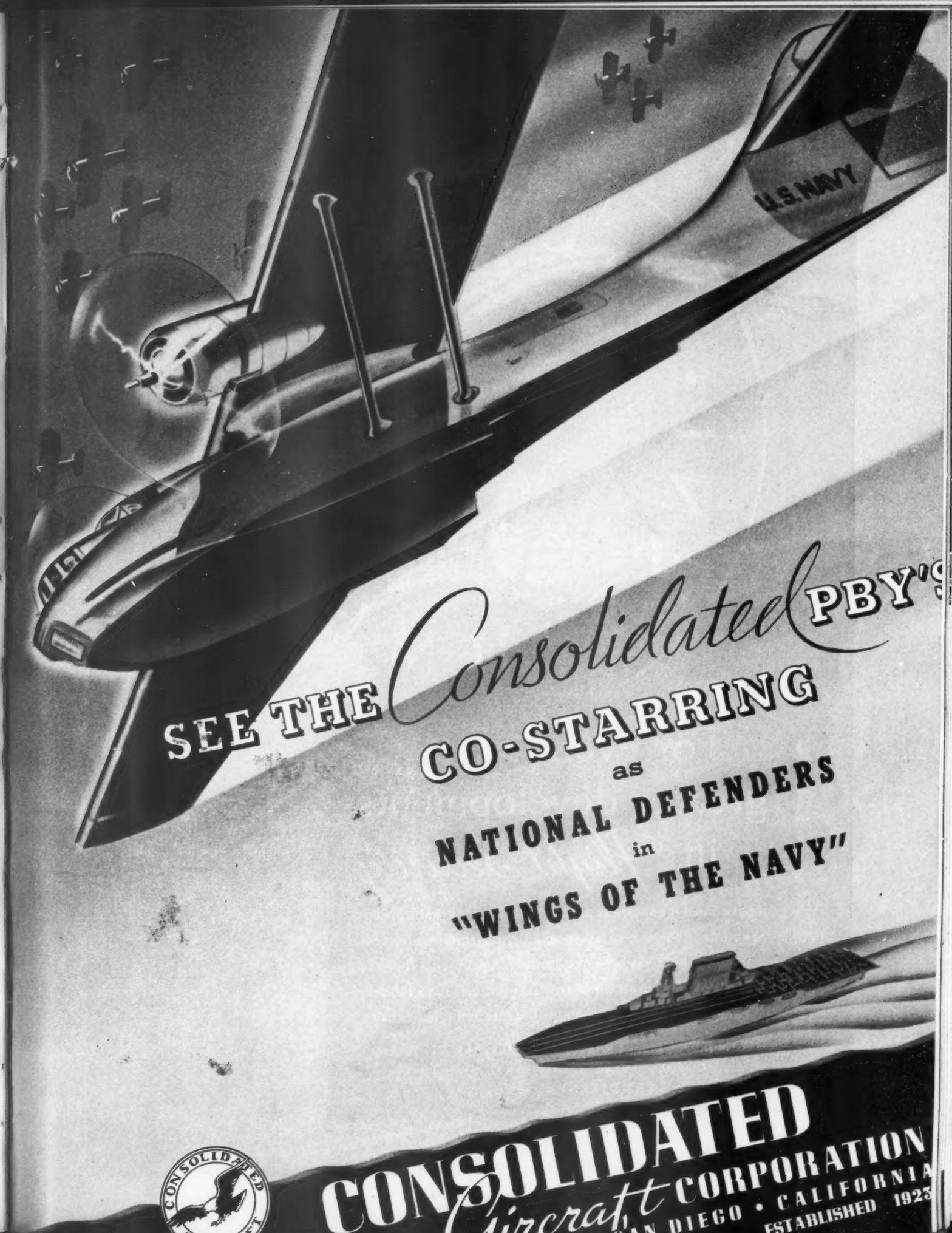
By linking the rudders to the ailerons in the two-control arrangement, the optimum relation between rolling and yawing moments can be obtained for one flight condition. In our case we have chosen for this relation the low speed condition because it is the most difficult condition in which to obtain satisfactory control. At high speeds our system therefore provides slightly larger yawing moments than would be ideal, but this can be noticed in flight only if an extremely sharp turn is made suddenly at high speed. Such a turn is made but rarely, and a bit of slipping and skidding accompanying it is of no great importance. A number of skilled pilots have flown the plane with both the two-control and the three-control systems, and it is an interesting observation that the slipping and skidding during the flights, as indicated by the ball in the bank indicator, has been noticeably less with the two-control than with the conventional three-control arrangement in use, unless the pilot paid special attention to flying carefully with the three controls.

One able test pilot, experienced in flying and testing all types and sizes of airplanes, flew the plane alternately with two, three, two, and three controls on an extremely gusty day, and he was considerably surprised to find that he noticed less bumpiness with the two than with the conventional three control arrangement. It seems that with only two controls he realized that he had incomplete control over the attitude of the plane and so he did not try so hard to overcome the effects of the gustiness. When he let the stability do the work for him he apparently had a smoother ride.

This brings up a change in point of view that it seems an experienced pilot of conventional airplanes must pass through before he can be satisfied with two-control operation. He has been accustomed to controlling the attitude of his airplane about all three axes as well as the flight path and the speed. With two-control operation he must be willing to sacrifice his control in yaw and to rely upon the stability of the airplane to prevent slipping and skidding in flight, and upon the stability of the landing gear to handle the drift in a cross-wind landing. Not until he feels fully confident that the airplane itself will take care of these items satisfactorily and without strain can he be expected to fly a two-control airplane with a feeling of comport and pleasure.

An interesting set of trials that brought out one of the advantages of two-control operation was recently made by Sanders. On a day with a high wind he made a series of take-offs from the College Park flying field, each time simulating sudden engine failure and a forced landing by closing the throttle at a definite point and then making a landing back in the field. During the trials he cut off his

(*Turn to page 76*)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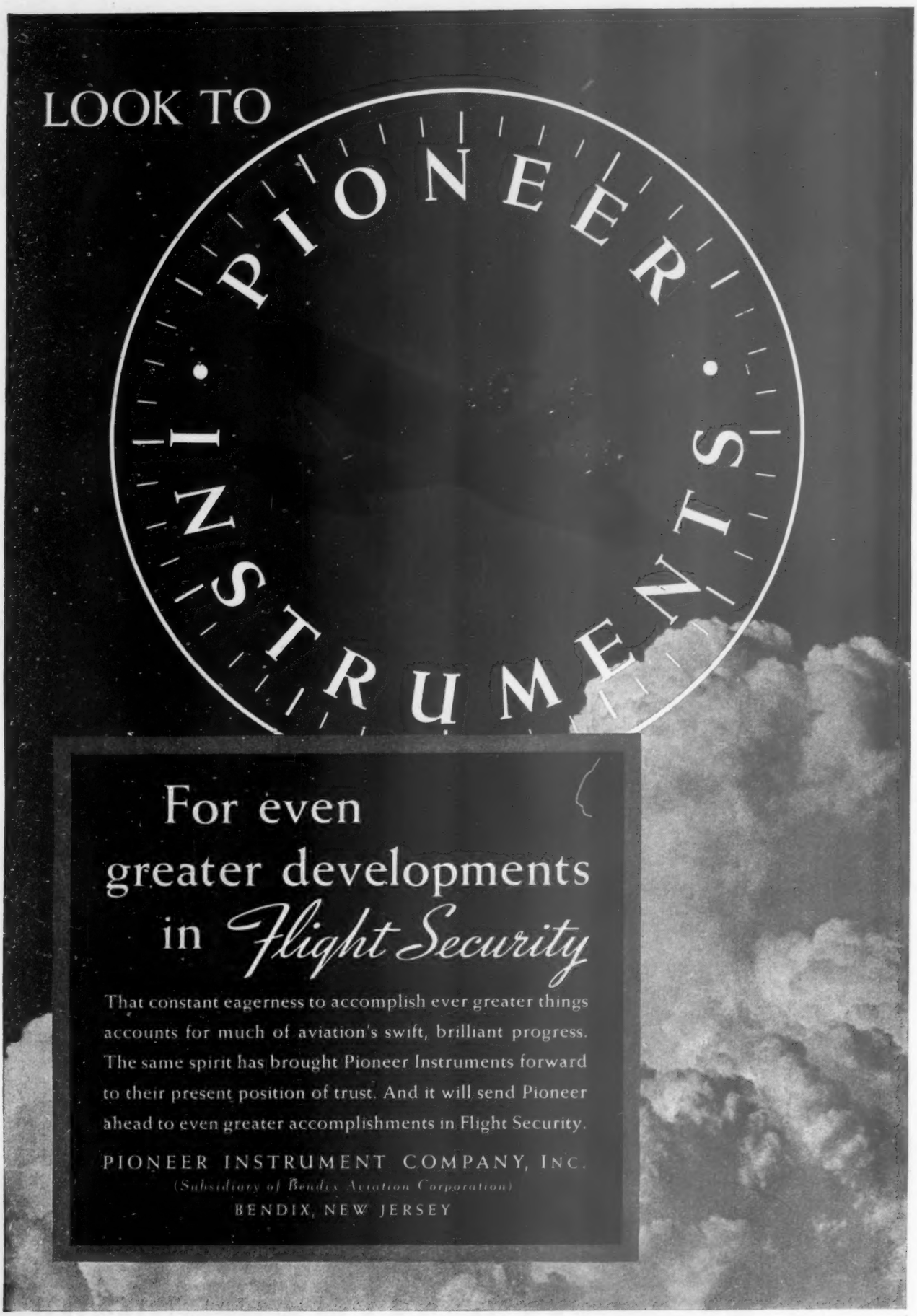
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AVIATION RADIO

Dialing the Air Waves with Don Fink

Bendix System

New Brochure Gives Details of U-h-f Development

A COMPLETE description of the new Bendix instrument landing system, which has been under development, with United Airlines cooperating, for many months, is contained in a bulletin recently issued by the Bendix Radio Corporation. The present review can indicate only a few of the highlights of the new system. Interested readers are urged to write for further particulars directly to the company.

According to the manufacturer, the system will make possible landing of heavy or light aircraft, from a distance 5 miles from the airport, at an elevation of 1,500 feet, to a runway not more than 300 feet wide. The landing path is free from irregularities sometimes noticed in systems using long wavelengths. In the Bendix system, however, the basic carrier frequency is very high, 93.9 Mc in fact, and no discontinuities occur.

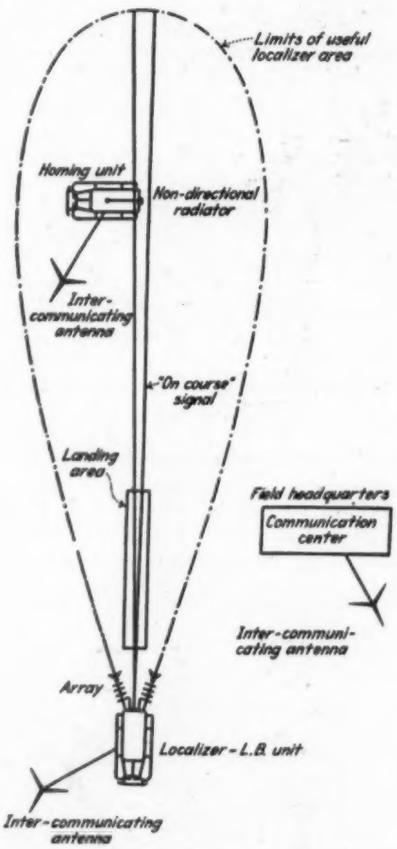
The transmitter may be mounted permanently at the end of the runway to be served, or it may also be mounted in a truck, which permits moving the equipment to the end of the runway which must be used, depending on wind conditions and other controlling factors. The transmitter itself has 300 watt output, obtained from a 3912.5-kc oscillator followed by a quadrupler, a doubler, a tripler, and a non-multiplying final amplifier, all of which use triode tubes.

The transmitter feeds two antenna arrays both of which perform dual functions: radiation of the desired field strength pattern and keying for identification of the two sides of the glide path. The two arrays, as shown in the figure, are substantially the same. Each consists of a horizontally-polarized group of five elements. The element nearest the feed-line acts as the radiator proper, while the four elements extending in front (toward the glide path) act as reflectors (strictly speaking they are directors) to provide the required strength and distribution of field. The gain of the arrays is about 13-to-1. The first of the four reflector-directors is keyed by mechanical relay. The keying interrupts the action of this reflector and effectively varies the signal strength along each side of the glide path. When the keying contact is open, minimum forward radiation is obtained, whereas when the reflector is closed, the maximum radiation is obtained. The arrays are arranged at an angle of 30 degrees, which gives adequate overlap between the two beams. One side is keyed at 90 cps, the other at 70 cps. In addition to the glide-path transmitter, a marker transmitter on 75 Mc. provides a "location" signal on the glide path, before the landing area is reached.

The receiving equipment consists of a unit designed for operation either from 12-volt vibrator supply, or from 800 cycle supply. The power supply contains a voltage regulator to maintain the receiver sensitivity constant. The receiver proper consists of an input tuned r-f circuit feeding a balanced detector (two tubes), in the output which appear the audio signals corresponding to the 70 and 90 cycle keying of the beam arrays. Two low pass filters and audio amplifiers feed a limiter and rectifier tube which delivers a signal proportional to the field strength. This signal is fed to the meter pointer which indicates elevation. Other audio amplifiers and a-v-c tubes apply the audio modulation to the other pointer of the indicating meter. This pointer is actuated by a mechanism which distinguishes the 70 cps modulation from the 90 cps, and this points left or right of center, depending on which of the modulating components is the stronger. When directly on course, both pointers take their center positions. When off course, the intersection between the two pointers give an approximate location of the plane with respect to the glide path, indicating whether above or below, or to the left or right. Automatic volume control is used only on the left-right "localizer" control, since this indication is made independently of the actual signal strength. The receiver is simple, compact, and very ruggedly constructed, to judge from its appearance. The 75 Mc marker signals are received on the usual marker-beacon receiver intended especially for 75 Mc service. Since this receiver is usually already available on the plane, it is not sold as a part of the standard equipment, but can be supplied if desired.

The landing trajectory has the following profile: 1400 feet at six miles from the transmitter; 1000 feet at 5 miles; 625 feet at 4 miles; 360 feet at 3 miles; 160 feet at 2 miles; 45 feet at one mile; and contact at 3330 feet from the transmitter. The localizer course (left-right indication) gives approximately a 20-degree indicator pointer variation for a 3.5 degree deviation from the center of the glide path.

For mobile installations, the 93-Mc path transmitter is mounted in a 1½-



Diagrammatic layout of the Bendix blind landing system

ton truck, and is powered from a gasoline-driven 60 cps power generator. The marker transmitter, for mobile use, supplies 750 watts unmodulated or 500 watts 100 per cent modulated, is gas powered, and feeds a non-directional antenna. The radiating arrays for the beam transmitter or mounted directly on the rear of the truck. A ground is obtained by driving a rod into the ground, or by the use of a radial counterpoise. An intercommunicating system to connect all units by radio is also provided, and feeds an antenna set up to one side the glide path.

"Gyromatic" D-F

Ward Davis of CAA and Lear Developments Combine Talents in New Compass

THE LEAR-DAVIS Gyromatic Direction Finder is an ingenious combination of an automatic "station-seeking" radio d-f, an airport map, and a gyro compass of the "airport orientator" type. The radio d-f is a standard Lear Type ARC-6 compass with a motor-driven loop which maintains itself on the null position (pointing toward any station to which it is tuned). From the loop housing a flexible shaft leads to the gyro compass instrument, shown in the accompanying illustration. The gyro instrument indicates the direction of the ship's flight on two separate scales, one viewed through a conventional window on the side of the instrument, and the other consisting of an open-face compass card mounted on the top of the case. The glass cover of this upper indicator can be opened readily and a circular map inserted on the compass face. The map contains the location of the radio range beacon station and the airport runways as well as the magnetic bearings of the on-course beacon sectors. The beacon station is so placed on the map that it falls directly on the center of the card. The entire map rotates with the gyro compass mechanism.

Above the map a transparent scale is mounted and so arranged that it is rotated directly by the flexible shaft leading to the compass loop. An arrow on this scale indicates the direction of the loop null position relative to the fore-and-aft line of the ship, which is shown as a fixed line on the top-most face of the instrument.

In using the instrument, the radio compass is first tuned to the beacon station (or run-way localizer) at the airport. Then the pilot picks out the on-course beacon path he desires to come in on, determines the magnetic compass bearing of that run-way from the chart on the compass face, sets the gyro index (a black triangle) to that bearing. He then uses the radio compass in its "homing" capacity, by keeping the long arrow directly on the fore-and-aft line. At the same time he attempts to keep the gyro heading, as indicated by the black triangle on the magnetic bearing previously set up. If it is impossible to keep the gyro and the radio compass lined up, the inference is that drift is being caused by a side wind. The difference between the homing angle and the gyro bearing is then equal to the crab angle necessary to maintain a straight flight along the on-course signal.

The compass indicates the position of the cone of silence of the beacon station by reversing its heading. When this occurs the pilot knows his position and heading above the airport and can then make the turn to the desired run-way. When landing, the run-way line on the map will be parallel to the fore-and-aft axis of the ship.

The advantage of the instrument, like that of the Metcalf system of blind landing, is in its integration of the indications of two instruments, the radio compass and the gyro compass. The pilot has the whole situation coordinated in the indications of one instrument, and is thereby relieved of much mental effect. Among the possibilities opened up by the new development are: automatic orientation; straight track (drift-corrected) homing flight; simplified instrument approaches; and parallel flight (lateral separation from a given route) either on an established course or to off-airway points.

Above: The Lear-Davis "Gyromatic" combined compass

Information

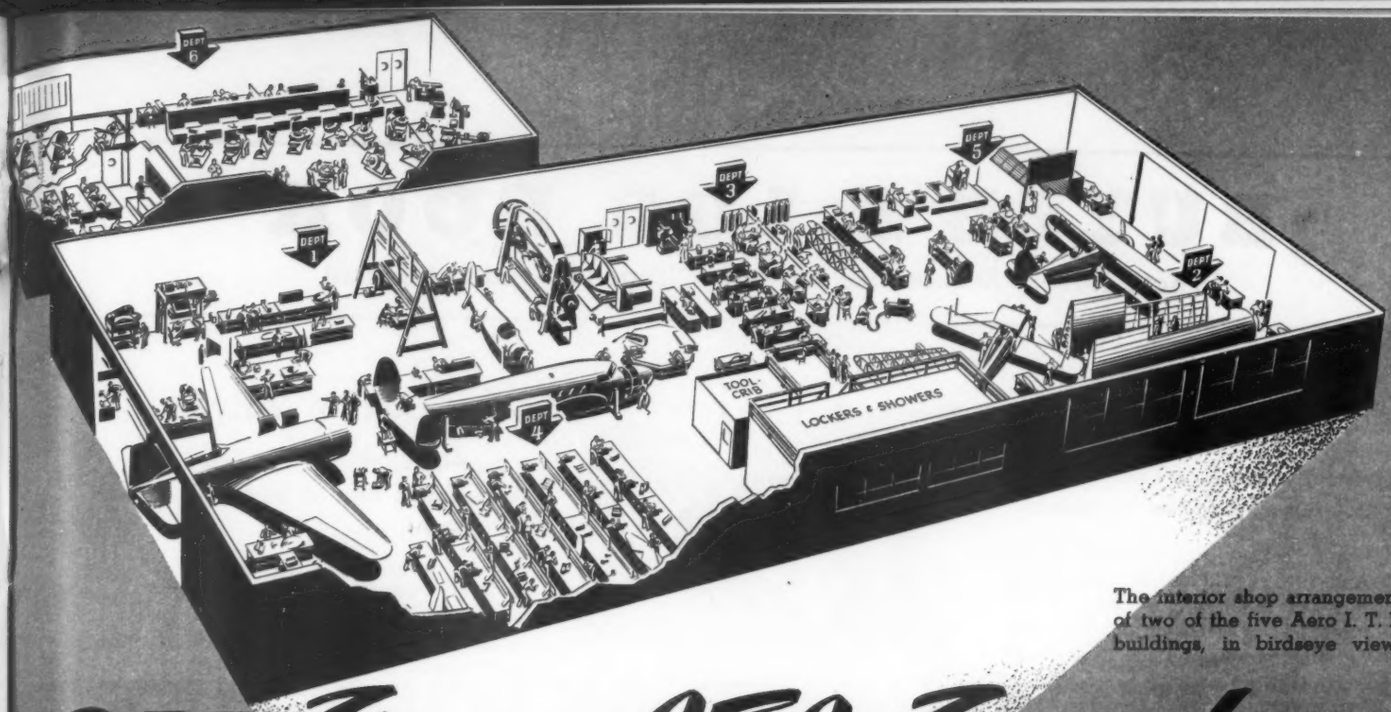
For Third Class Radiotelephone Applicants

TWELVE PAGES of hints, helpful for applicants for Third Class Radiotelephone Operator's License, are contained in "Radiotelephone Third Class Information" published by Radio Information, 5214 W 63rd St., Chicago. The booklet reduces the requirements to their simplest terms, states the privileges and responsibilities of the third class ticket, gives the answers to twenty typical examination questions, suggests proper operating procedure, and defines 50 commonly used technical terms. It is recommended to those who have but little knowledge of radio, and who desire to meet the requirements for this operator's license.

Text

British book covers fundamentals and practice of modern D-f work

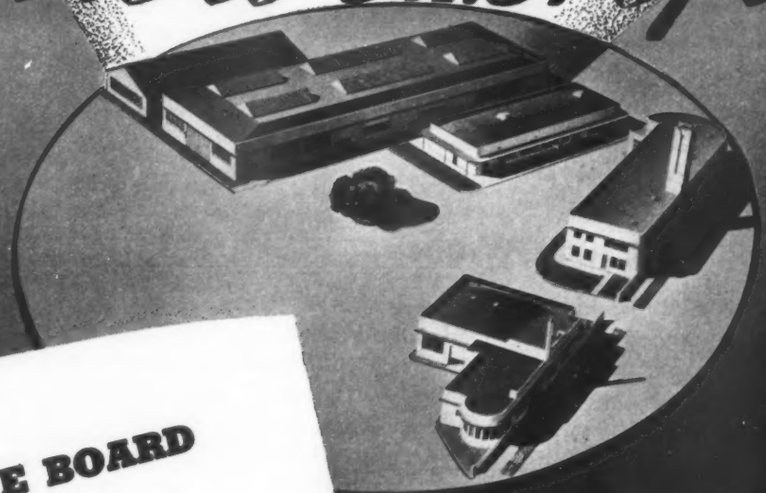
A BOOK WORTHY OF THE ATTENTION of all engineers engaged in the development and operation of direction finding equipment is "Wireless Direction Finding" by R. Keen, published by Iliffe and Sons, Ltd., Stamford St., London, S.E. 1, at 25 shillings. The book is over 800 pages long, is well written and complete in all departments. While British terminology is used, the author has reviewed American practice and equipment fully as well as the British. Among the systems described at the Bellini-Tossi and the Adcock, as well as the conventional loop reception types. Both marine and aeronautical applications are covered. Four chapters are devoted directly to the applications of direction finding in aircraft, while other chapters describe ground stations, maps, position finding, nautical astronomy, the effects of polarization errors, night effect, etc. The treatment is simple and the authors' gain, quoting from the preface "has been to make the book acceptable not only to the engineering student but to the radio-telegraphist, the air pilot, and the installing technician." While the mathematical sections are included they are not essential to understanding the subject matter. The book is the third edition, the second edition having appeared in 1927, before any great use was made of direction finding in aircraft.



The interior shop arrangement of two of the five Aero I. T. I. buildings, in birdseye view.

357 Aero I.T.I. Graduates

Were Employed by Aircraft Plants in the Last 12 Months



During the last 12 months, 357 graduates of Aero I. T. I. have been employed in the aviation industry... recognition of the value of Aero I. T. I. training brings enrollment to a new high record... Aero I. T. I. adds a complete new engine shop and laboratory building ...and enlarged facilities for instruction in Aeronautical Engineering... Offers C. A. A. approved 1-year course in Master Mechanics... 6-months Airplane Craftsman Course... Combination Home Theory and Residential instruction... complete training in Aeronautical Engineering, Design and Drafting ...On its five-acre campus, Aero I. T. I. has complete and modern shops, laboratories and class-rooms... newly built from the ground up to meet the exacting requirements of aircraft industry training.

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BUYER'S LOG BOOK

What's New in Accessories, Materials, Supplies, and Equipment

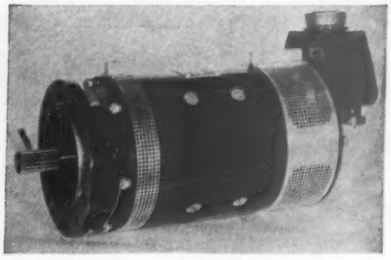
Eclipse Generators

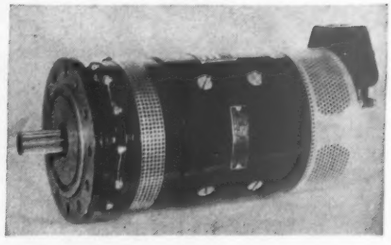
New types produce 1500 watt output without increase in weight.

DOUBLED output with virtually no increase in weight is the outstanding feature of the latest addition to the Eclipse line of generators. The new generators produce 1,500 watts and are available for either 12 or 24 volt d.c. operation. They are rated at 15 volts, 100 ampere and 30 volts 50 ampere output, respectively. The horsepower input is approximately 2¾. They may be procured for either direction of rotation, one or two wire system, and with either the square or round generator mounting flange incorporating 6 tooth drive spline or 16 tooth involute spline as required. Shielding is optional in Air Corps type or standard 1⅞ in.—18 commercial. The 15 volt generator weighs but 36¼ lb. and the 30 volt, 34 lb. The full charging output is obtainable over a generator speed range of from 2,600 to 4,500 r.p.m. An integrally mounted fan provides the necessary cooling. The 30 volt unit utilizes the conventional type of flexible rubber coupling with solid armature shaft, while a torque shaft, of the pencil type with hollow armature shaft, is contained in the 15 volt generator, to absorb torsional engine impulses.

Additional features provided are the balancing of the ball bearing supported armature shaft both statically and dynamically, improvements in brush spring design, to improve commutation and give longer brush life together with more simplified brush rigging, resulting in more efficient and dependable operation.

Conventional type shock-mounted control boxes of the standard and detachable types, incorporating a voltage regulator, current limitator and reverse current relay, are available to provide consistent, automatic regulation of the generator output. Shock mounted control panels, for junction box installation, include a voltage regulator and reverse current cutout for installations of the type requiring this form of control. — AVIATION, *April, 1939.*





Two of the new Eclipse high output generators.

Indicating Wrench

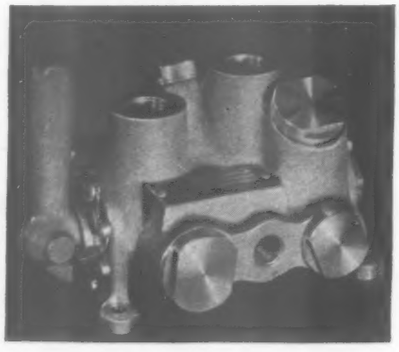
Red signal flashes when strain reaches predetermined magnitude

MODERN maintenance requirements have made it essential for every aircraft mechanic to be equipped with a torque indicating wrench for such operations as tightening spark plugs, cylinder head nuts, or cylinder hold down studs, connecting rod bearing studs, manifold bolts, etc. A number of torque indicating wrenches have been developed. One of the newer such wrenches is the Torkflash, offered by the Blackhawk Mfg. Co., of Milwaukee, Wis. The Torkflash is simple and light in weight. Basic principle is deflection of the steel wrench handle proper under strain. This deflection is indicated in inch pounds or foot pounds according to setting desired and when the required strain is exerted the wrench flashes a red warning signal. This is provided through incorporation of a standard small flashlight battery and bulb in the handle, and makes the wrench especially valuable for use at night or in dark corners where a scale reading would not be easy.—AVIATION, *April, 1939.*

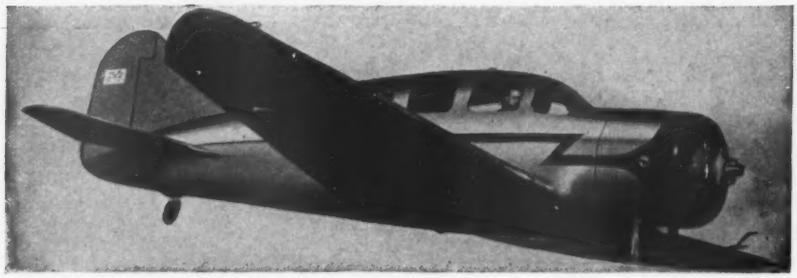
Way Control Valve

Latest addition to Aircraft Accessories line of hydraulic equipment

LATEST development in the line of hydraulic actuating equipment manufactured and distributed by the Aircraft Accessories Corporation, of Glendale, Calif., is a four-way directional control valve incorporating several novel features. The Aircraft Accessories valve operates with very slight pressure, making it practicable to mount it in the plane at points remote from the point of control, operating the valve by means of rods or cables. Under 1000 lb/sq/in. hydraulic pressure the valve operates with 6 lb. of force exerted on a 2½ in. handle. It is positive in its action and absolutely leak proof, having no internal packings subjected to wear. All internal parts are standard and interchangeable, and are so arranged that they may be removed for servicing without disconnecting the plumbing or removing the valve from its mountings. To meet Army Air Corps requirements the valve is designed so as not to be affected by surges of pressure, and other valves in the system may be operated without interflow of fluid from one mechanism to another. Tests under 1000 lb/sq/in. for over 10,000 cycles failed to produce measurable wear on any of the parts, indicating high initial life for the valve without servicing or maintenance operations.—AVIATION, *April, 1939.*



Four way hydraulic control valve by Aircraft Accessories



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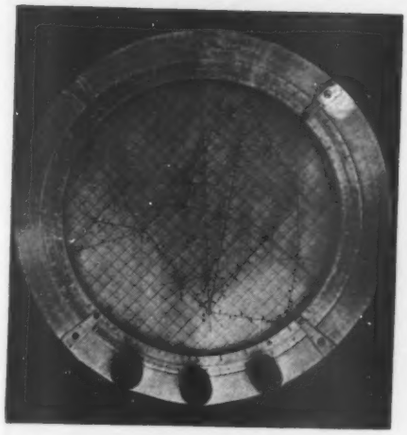
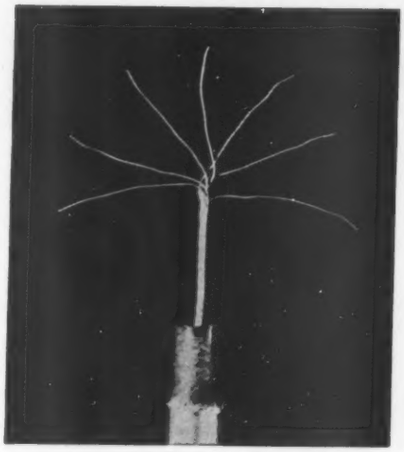
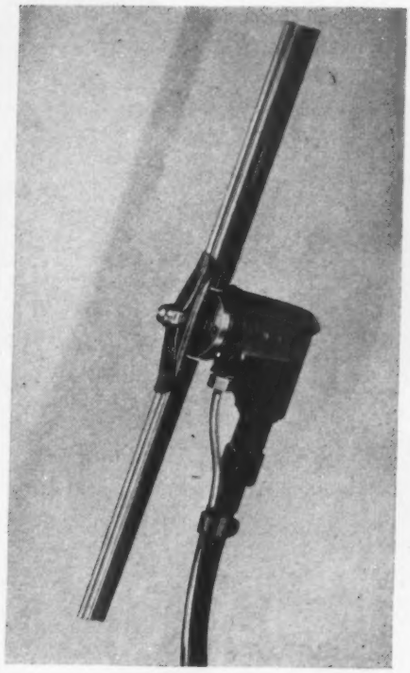
RELIABLE ENGINES FOR MILITARY TRAINERS, PRIVATE AND COMMERCIAL AIRPLANES



Stark Position Indicator



Low Capacitance Steelductor



Left: Wiper and driving head. Right: Shielded motor with metering pump for deicer fluid built into head

Stark Position Finder

Pilots need only one hand to locate map position with this device

UNTIL evolution gives transport pilot six eyes and six hands he will welcome the Stark Position Finder, developed by Capt. Horace Stark, veteran pilot and recognized authority on air navigation. The Stark position finder may be operated with one hand and eliminates entirely the manual plotting of position, locating the map position of the airplane on the basis of radio signals picked up by the radio automatic direction finder. The position finder employs a replaceable transparent map of the radio range and broadcast stations in an area 520 miles in diameter, covering the route over which the pilot is flying. Twenty-two such maps cover the entire country. Beneath this map are two discs, rotatable and transparent which bear parallel lines. The pilot tunes in two radio stations on his direction finder and transfers their compass bearings to the position finder by properly aligning the lined discs. Where the lines of the two discs intersect, as seen through the transparent map, is his exact position. All Pennsylvania-Central Airlines pilots use the Stark position finder, and the instrument has been made available to other airlines and private pilots.—AVIATION, *April, 1939.*

Windshield Wiper

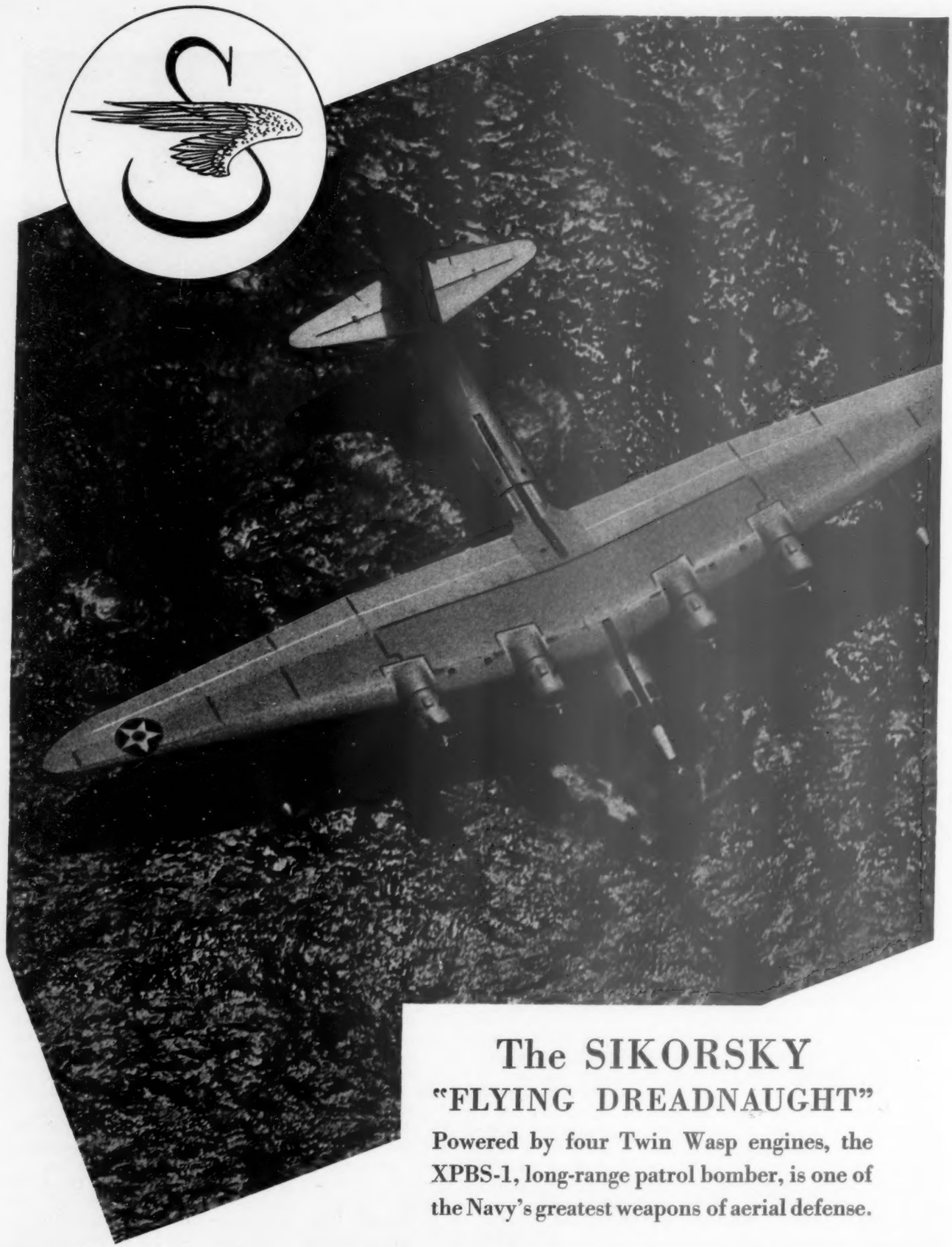
Electrically operated rotary unit has de-icer fluid attachment

A MAJOR CONTRIBUTION to bad weather vision has been made by Air Associates, Inc., of Garden City, N. Y., with a new electrically operated rotary windshield wiper which is said to keep a circular area positively free of rain, ice, sleet, spray or snow under any conditions. A special de-icing fluid attachment provides for clear vision under icing conditions. The driving shaft of the wiper passes through a hole in the glass and carries the blade, the wiping edge of which is a special composition material not affected by oil, gasoline, sunlight, or extreme cold. Speed of the rotary blade may be controlled at any point up to 2,500 r.p.m. —AVIATION, *April, 1939.*

Sterling Steelductor

Seven Strand Stainless-Steel Wire Used in New Ignition Cable

KNOWN as Sterling Steelductor, a new ignition cable developed by Dr. Melville F. Peters, of the National Bureau of Standards, has been announced by the Sterling Cable Division of the Electric Auto-Lite Company, Port Huron, Mich. A large percentage of Naval aircraft have been using such ignition cable for some two years now. Vast improvements in ignition performance, with consequent improvement in engine efficiency, are claimed for the new cable. Chief characteristic of the cable is its low "capacitance," which simply means that the cable itself absorbs very little of the electrical energy transmitted through it. Advantages in engine operation claimed for the new ignition cable are: 1. Easier starting, 2. Increased top speed, 3. Lower idling speed, 4. Reduced burning of spark electrodes, 5. Less misfiring from fouled plugs, 6. Avoids internal corona, 7. Reduces effect of heat on cable insulation, and 8. Less radio interference. Chief feature of the cable is the use of only seven strands of stainless steel wire, which provides a proportionately greater thickness of insulating material.—AVIATION, *April, 1939.*



The SIKORSKY
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Powered by four Twin Wasp engines, the XPBS-1, long-range patrol bomber, is one of the Navy's greatest weapons of aerial defense.

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THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

APRIL 1939

DANIEL SAYRE

C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield, *Washington*
E. R. Lockin, *New York*

Army Changes Rules on Pilots, GHQ

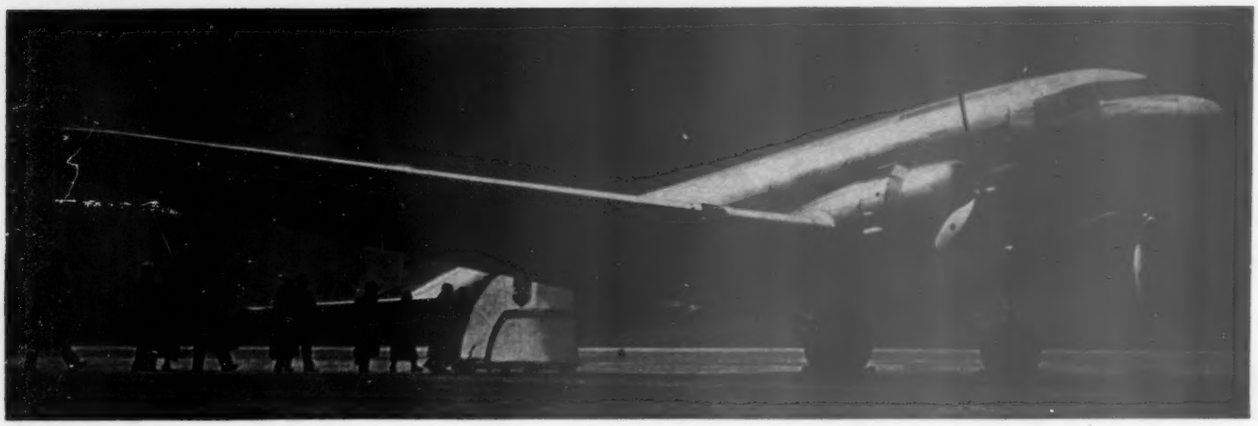
(Story on page 51)

McLaughlin Air Service

GATEWAY TO THE FAIR: North Beach Airport, New York's super-magnificent air terminal for land and sea transports, rushes toward completion as WPA men work in three-shift armies to have it ready by the time the World's Fair opens for business two miles away. Note its proximity to mid-town Manhattan.

"I CHRISTEN THEE YANKEE CLIPPER": Mrs. Roosevelt does a beautifully thorough job on Pan American Airway's first entry in the trans-Atlantic transport sweepstakes. The gentleman sharing the shower-bath is Juan Trippe, Pan American President and General Manager.

Wide World



Big-4 Air Lines Report on 1938

American Makes $213,262

IN ITS ANNUAL REPORT released March 16 by its president, C. R. Smith, American Airlines shows a net profit for 1938, after provision for income taxes, of $213,262. This compares with a net loss of $93,627.56 for 1937. Operating 15,314,792 revenue miles during the year, this amounts to an average profit of 1.39 cents per revenue mile flown.

Passengers carried in 1938 were 358,295 compared with 300,571 during the previous year, an increase of 19.2 per cent. Revenue passenger-miles jumped 14.4 per cent to 140,869,290. Again in 1938, as in 1937, American Airlines transported 30 per cent of all passengers carried by the domestic air lines.

American deserves congratulations on its outstanding safety record. At December 31, 1938, it had flown 46,895,929 airplane miles and carried 1,011,697 passengers 410,236,966 passenger miles without an accident involving passenger fatality. Then, on January 14, 1939, the line completed three full years of operation without an accident involving passenger fatality.

American points out that on its transcontinental route it receives a base air mail pay of 23c per mile for the first 300 pounds and 2.3c per mile for each additional 100 pounds on the New York-Fort Worth section, and 25c per mile for the first 300 pounds and 2.5c per mile for each additional 100 pounds on the Fort Worth-Los Angeles section. One of the other transcontinental lines receives 30c for the first 300 pounds and 3c for each additional 100 pounds; while the remaining line gets 31c for the first 300 pounds and 3.1c for each additional 100 pounds. The maximum in each case is 40c. Since all three companies are carrying the same type of mail in similar equipment for the same unit of distance, American has filed a petition with the CAA seeking an adjustment of this differential.

Five of the ten additional 21-passenger Douglas Flagships which American Airlines had on order for delivery this year will be delivered by March 10. The remaining five are to be delivered during May.

United Loses $997,221

IN ITS ANNUAL REPORT for 1938, United Air Lines discloses a loss of $997,221 as compared with a loss during 1937 of $754,486; this loss was registered despite the fact that passenger revenue increased 6.03 per cent, and mail revenue increased 7.17 per cent. Express revenue decreased 7.36 per cent. Total operating expenses and taxes rose $673,516, or 6.54 per cent.

During 1938 United flew 15,508,952 revenue airplane miles. Revenue passenger miles increased from 97,607,954 in 1937 to 108,873,302. Air mail carried amounted to 4,833,498,228 pound-miles, 5.3 per cent over the preceding year. Air express total was 1,509,360,023 pound-miles, a decrease of 2¾ per cent.

The company is soon to have a hearing on mail rate revision by the CAA, and is hopeful that it may receive more adequate compensation for the transportation of mail. President W. A. Patterson of United strongly urges a pound-mile basis of mail pay.

Eastern Profit, $354,249

EASTERN AIR LINES' PRESIDENT, E. V. RICKENBACKER, announced in his annual report issued March 7, 1939, that after making deductions for depreciation and amortization and for Federal income taxes, the company made a net profit for the year, 1938, of $354,249. This compares with a net profit of $196,982 for the previous year. New routes acquired during the year include one from Atlanta to Tallahassee and Tampa and from Tallahassee to Birmingham and Memphis, and one from Brownsville to Houston and Houston to San Antonio. These routes will give Eastern a total route mileage of 5,328 miles raising it from fourth to second place among domestic air lines.

In February Eastern Air Lines was awarded the contract to carry mail in a six-mile shuttle service from the roof of the Philadelphia Post Office to Camden Airport. The contract calls for five round trips per day, daylight operation, six days per week for a period of one year. The pay for this service will be $3.86 per mile. It is hoped to start operation of this service some time in June with a Kellett Autogiro.

This machine will be the first of a new Kellett design offered for mail and express service. In general construction it will be somewhat similar to the military models supplied to the Army Air Corps. It will be a one-place ship with closed cockpit and a large mail compartment. Equipment will include essential navigation instruments for blind flying and the exacting requirements of roof-landing.

TWA Loses $773,263

TWA'S ANNUAL REPORT for 1938 dated February 17, 1939, shows substantially increased business and operating revenues over 1937. However, increased operating expenses, which include increases of $35,535 in taxes and $65,000 in payroll as well as higher airport rentals and prices of materials and supplies, more than offset the improvement. The net loss for 1938 was $773,263 as compared with $686,074 for 1937. These figures have been adjusted to give effect to the additional mail revenue granted by the retroactive mail rate increase authorized by the Interstate Commerce Commission in their order of December 22, 1938. TWA points out that it carries 18 per cent of all air mail transported in the United States, but receives only 14 per cent of the total payments made to air mail contractors. It is, therefore, hoping for a favorable action on its application for further increase in mail pay.

During the latter part of 1938, service was inaugurated on a new route between Phoenix, Arizona, and Boulder City, Nevada, where connections are made with the transcontinental route and the Boulder City-San Francisco route. TWA now has in service 33 Douglases, ten of which are Skysleepers, nine are Skyclubs. Fourteen are fourteen-passenger DC-2's.

In anticipation of a large increase in traffic during 1939, due chiefly to the San Francisco and New York World Fairs, TWA is launching the most ambitious flying schedule in its history. The new program is expected to cost the airline an additional $1,075,000 in advertising, equipment, and operating expenses during the year, and will add nearly 2,000,000 seat miles monthly to its present flying load. In several instances, notably the Chicago-New York service, previous schedule frequencies are doubled.

Air Corps Clears Decks for Action; Reorganizes GHQ and Pilot Set-Up

In clearing the decks to make way for the largest peace time expansion program ever undertaken by a branch of the U. S. Military services, a number of significant steps were taken early in March concerning a new group of policies for the Air Corps. The developments include: I. Placing the General Headquarters Air Force under the Chief of the Air Corps. II. Re-classification of all flying officers, including the establishment of a new rating of "Command Pilot" for the older, more experienced officers who will command large planes or groups of planes but will not necessarily serve at the controls. III. Setting up of a new set of standards of physical requirements for flying including three classes: 1. For applicants, students, senior pilots, pilots, and combat observers. 2. For senior pilots, pilots, and combat observers who can not qualify under Class One but who for special reasons may retain their ratings by coming in under Class Two. 3. For combat and technical observers. IV. Increasing the output of students at the Air Corps Tactical School from 70 per year to 400 for the next year by reducing the course from one year to three months and increasing the size of the average class from 70 to 100.

Ever since its inception four years ago, the Commanding General of the GHQ Air Force has drafted its own training schedule and plans and cleared them directly through the War Department without going through the Office of the Chief of the Air Corps. This same procedure has held in the handling of personnel for the GHQ Air Force. However, with a greatly increased Air Corps and resultant enormous problem of training new officers, it is felt that the handling of personnel to administer all the new activities would be difficult enough for one head without being further complicated by having two directing heads. In addition, since the Office of the Chief of the Air Corps handles research and procurement and therefore knows what is in sight in the way of new developments, it is better prepared to plan training with a view to future material.

The re-classification of flying officers is a direct result of the investigation starting some months ago following the death of a few of the older, more experienced men while piloting airplanes. It was desired to keep the younger men with quicker physical reactions at the controls of the planes, but at the same time to take full advantage of the wealth of experience gained by the older officers in their long flying careers. This has resulted in the creation of the new rating, "Command Pilot," who will be the senior member of the combat crew upon "whose decision depends the successful completion of the combat mission and the safety of the plane and crew." Although the announcement says that the "Command Pilot" will "not necessarily" be at the controls, it is understood that the regulations, as drawn up, will be specific in stating that an officer holding such rating will not perform pilot's duties unless he also holds a Senior Pilot's rating at the same time.

The new standards for physical examination are designed particularly to retain for flight duty older officers who can no longer pass the stringent physical tests given new pilots or candidates for the training course. This results in a relaxation of the tests for vision, hearing, and general robustness, but since these tests are to accompany the new rating system, such pilots as are unable to pass the more difficult tests will not be permitted to actually fly the airplanes.

The Air Corps Board expected that the task of rating all officers would be completed by April 1. When they are so rated, the three classes of physical examination will be applied to them.

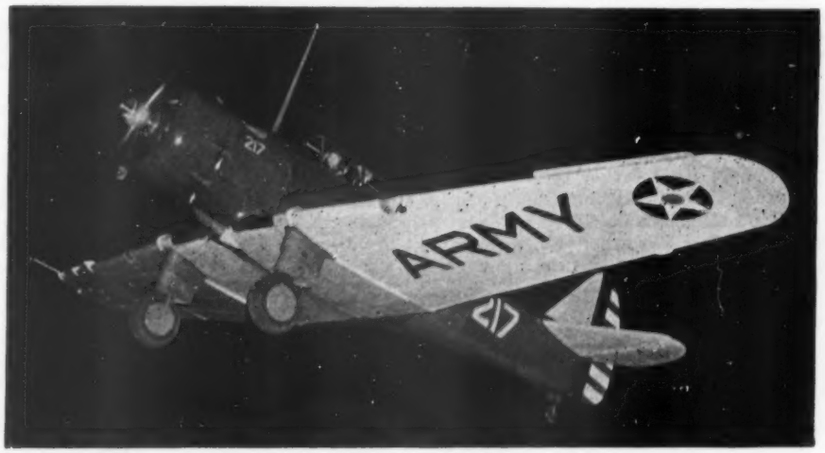
Class 1, the most stringent tests, will be applied to applicants for flight training, those undergoing flight training; rated senior pilots, pilots and combat observers.

Class 2 will be applied to senior pilots and combat observers who can not meet the standards of Class 1, and yet whose training and experience are such as to compensate for the lower physical standards.

Class 3 will apply to rated command pilots and technical observers.

The temporary reorganization of the Air Corps Tactical School at Maxwell Field is being done so that all Air Corps officers who have not taken the course may do so now. In this manner the way may be cleared to push incoming officers through the school as soon as they are due for it.

Although there are now about 600 Air Corps officers who have not taken the course, a number of them will become technical officers and go to M.I.T. and similar schools instead of the tactical school; therefore, it is expected that one year of the short courses will take care of the needs of the existing officers. The school can then return to its normal program.



NIGHT FLIGHT: A remarkable flash-light photo of a BT-9 over Randolph Field.

AVIATION IN WASHINGTON

by BLAINE STUBBLEFIELD

Senate chews Guam, and why? Some of our smartest swivel chair seamen say the Administration asked for Guam so that the Alaskan air base could be slipped in unnoticed. For years the Navy has wept for Kodiak and has always been slapped down. Now, as the far North base becomes a reality, no hand or voice is raised against it. Such law-making shenanegans are not uncommon in this marble city. If this *was* a trick it fooled the Nippons as well as Congress. The out-most Aleutian islands are nearly as close to Japan as Guam is, and they're on the short way around. Of course it should be noted too that there are no constituents in Guam for congressmen to fight for, but neither are there any on the Aleutians—except the seals, which don't vote. The Army will get an Alaskan base, too.

Trans-atlantic rates on mail and passengers will be set by CAA after hearings which are scheduled to begin April 3. Some gloomy persons who watched the snail-pace testing and report writing on the Boeing clipper say it will take CAA all summer to set rates at that rate. They have no idea whether Pan American would like to start under temporary rates or not, but if so, then CAA should come across, or put a burst of speed on permanent rates. This department, as impartial observer, can't say whether CAA is slow or not, but we do see them working at all times of night. (That includes us. Get it?)

There has already been some complaint that CAA has been slow in grinding out Certificates of Convenience and Necessity. It *was* slow. But if you're in a benevolent mood you can defend the Authority by pointing out that the issuance of every C. of C. & N. had behind it a vast amount of groundbreaking study of its economics, its geography, its relation to other lines, its prospective future, and your grandmother's maiden name. The last certificate, making a guess, will come out of the hopper about the time you read this.

"Thirteen Go Flying" was the title of an adventure movie which Samuel Goldwyn was making, based on the sinking of the British Cavalier. The State Department sent a letter to Will Hays, calling his attention to it. Newspapers reported that State had done this at behest of Pan American Airways, which thought the picture would damage forthcoming transatlantic business. Domestic operators' first reaction: Why not protect *us* from cockeyed movies, too? Personal investigation by this writer shows that the State Department behested for nobody at all—was simply concerned with good international relations.

Air mail rates are about due for determination by CAA. Of 18 major mail contractors, 11 applied for rate adjustments. Presumably the others decided they would rather keep what they've got than risk getting trimmed to less. If you had listened to those laborious days of hearings, you would assume, as most did, that in general the carriers are getting less than just compensation for services rendered. Testimony on Pan American Airways makes the most complete picture of an airline's financial affairs as ever has been put on paper. It is so voluminous that the Authority will need several weeks just to "process" it.

Ides of March came and went and the CAA airport survey was a few days late. It was noised around the country that those who wrote the first draft had muffed the job, and that it had to be done over by better men. A member of the Authority tells us that CAA expected preliminary data from initial writers, nothing more. It was up to the Administrator and the members themselves to study the material and report to Congress, not merely to sign something. Despite this generous protest, opinion here still is that the first draft was botched. Recommendations will almost certainly suggest government spending for airports.

Gravelley Point, the nation's model airport, is rising magically out of the yellow Potomac. Huge suction dredges, rooting on the river bottom, are finding a much better grade of gravel than was expected, and are building exceptionally solid acres. A couple of the world's biggest dredges, one 27 inches and one 28, both privately owned, recently arrived on the job. One was towed all the way from New Orleans.

Senate Standing Committee on Aviation seems improbable this year, for at least two reasons. One is that the Senate Commerce Committee wants to keep the job of handling civil aviation. Sen. Vandenberg, a member, argues there are too many standing committees now, and besides that, the Commerce aviation sub-committee, says he, has done a good job, as witness passage of the Civil Aeronautics Act. Another reason: Senator Pat McCarran, recognized as the daddy of recent air legislation, despite claims of others who put in a later oar, now has some support in the industry and on the Hill for the chairmanship, if and when one is set up. This same support might go against creation of a committee unless Sen. Pat was "it."

Ziss Boom Bah! All 13 college pilot training centers are working smoothly under contracts with instructors, ranging from $195 to $250 for 35 hours. Fifty hours are given if necessary. All students are collegiates thus far but training will be open on an "extension" basis for outsiders. Only criticism heard here-about is that the US already has some 25,000 pilots who are going, (or gone) to seed for lack of something to fly; that this new training program will just add more to the kiwi hosts. Your answer, if you want one, is (1) that the younger element in the 25,000 will be drawn into the new program and given better training, and (2) that the existing flock is, in general, spottily trained, and has put private flying in bad repute. Army feels that the main benefit of the training will be reduction of the high attrition rate on cadets.

Mr. X of the Air Safety Board, as you know by now, was C. B. Allen, long time aviation editor of the New York Herald Tribune, and last few months press relations chief for CAA. You hear a variety of reasons why Allen was impaled on the waiting hook after Senate had confirmed the rest of the Authority, but this is as good as any: The airline pilots have nothing against Allen but, having fathered the Safety Board, naturally wanted another of their men on it. The Airline Pilots are affiliates of the American Federation of Labor, which cracks a loud whip on the Hill.

Spare Parts: US loan of $120,000,000 to Brazil will help our market there for civil and military airplanes. . . . WPA reports that it constructed 154 new airports and improved 494 others in three and a half years ending Dec. 31 last, at a cost of $112,000,000. . . . Reorganization of the Aeronautical Chamber of Commerce *was* augmented by War, Navy and other departments; it's a live-wire concern now. . . . There will be no airplanes in the educational orders program as first proposed. . . . There will be no government-owned aircraft plants just yet if ever. . . . Talk about moving plants away from the coasts was palaver by inland newspapers. . . . Critics say the CAA aircraft development section is doing nothing worth while. . . . NAA's aviation forum here added up to a good healthy shop talk.

WRIGHT CYCLONES
power the
BRITISH "HUDSON"
LOCKHEED B-14 BOMBERS
ordered by the
BRITISH AIR MINISTRY

The imposing fleet of British "Hudson" twin-engined reconnaissance-bombing planes—the Lockheed Aircraft Company's B-14 type recently ordered for the Royal Air Force of Great Britain —will be powered exclusively by 1100 H. P. Wright Cyclone engines.

A military version of the Wright Cyclone-powered Lockheed 14 Transport with which Howard Hughes flew around the world in the record time of 3 days and 19 hours, the "Hudson" ranks as one of the swiftest and most efficient bombardment types ever developed. Its speed, cruising range and great striking power make it an important addition to the British Empire's aerial fighting forces.

The Lockheed 14 Transports, from which this advanced bomber version was developed, are now in regular service on airlines both here and abroad, notably on British Airways, K. L. M. (Royal Dutch Air Lines), Roumanian Air Lines, and K. N. I. L. M. (Royal Netherlands Indies Airways), where they are powered by Wright Cyclones.

WRIGHT AERONAUTICAL CORPORATION
Paterson **New Jersey**
A Division of Curtiss-Wright Corporation

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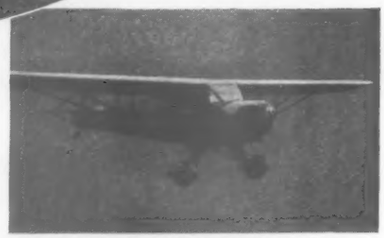
Flagship of America's Low-Priced Airplanes



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Think of the pleasure which can be yours with a plane of your own — how quickly and easily you can go places wherever and whenever you choose. In the dependable low-priced Taylorcraft, you're hundreds of miles away in a few hours, flying with ease and comfort, high above crowded road traffic, on the skyways of a beautiful, interesting, new world.

No longer is flying expensive or difficult to learn. Superb flying characteristics, snappy performance, and effortless control will quickly prove to you that flying a Taylorcraft is almost as simple as driving an automobile — and much more thrilling sport. The cost is amazingly low — far less than you might expect.

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Be sure to ask for a demonstration flight — and try the dual controls yourself. That's the way to fully realize the delightful pleasures which await you in a Taylorcraft of your own.

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TAKE A TRIAL FLIGHT

See the beauty, comfort and thrilling performance — the extra value offered you in the dependable low-priced Taylorcraft.

Taylorcraft

Southern California Seeks New Funds

J. K. Northrop to reenter field with new manufacturing company

THE IDES OF MARCH found new financing programs and announcements of new aviation manufacturing ventures flourishing mightily in the air-minded Southern California area. As we go to press indications are that from $5,000,000 to $7,000,000 of aircraft financing dealing with Southern California firms, will reach the market within sixty to ninety days. More than half of the new money will go into entirely new ventures.

Heading the list of new and interesting projects is Northrop Aircraft, Inc., which is understood to have the backing of capital supplied by a group headed by Lamotte T. Cohu. Preliminary plans are said to call for a stock issue of from $1,500,000 to $2,500,000, with the erection of a new plant in the Los Angeles area for manufacture of military aircraft designed by John K. Northrop. It is understood that Northrop will serve as chief engineer of the new firm, and Gage Irving, now assistant general manager of the El Segundo Division of the Douglas Aircraft Company, is to head the production department.

Largest Los Angeles financing is that of Lockheed Aircraft Corp., which offered 112,454 shares of common stock, at $31 a share, on March 7th. Net proceeds from the sale of this additional stock will total $3,129,520. According to its SEC registration statement the company will use approximately $300,000 for the construction of new buildings and hangars, $620,000 for the purchase of additional tools and equipment, and $1,240,000 for development of the new model 16, model 22 and model 44 airplanes. The balance would be used for working capital.

Menasco Manufacturing Company, engine builder, is expected to file application for an issue of about 100,000 shares to be offered at market price, which is now about $4 per share. This money would be used largely for working capital and development of new engines.

Two entirely new issues expected soon are: Allied Aviation Corp., offering 50,000 shares of $1 par value stock to finance production of the Monsoon inverted in-line engine; and Aircraft Accessories Corp., manufacturers of hydraulic actuating systems, which will market 60,000 shares of $1.50 par value common stock. An early announcement is also expected on financing plans of Vega Airplane Co., subsidiary of Lockheed and developer of the new plane powered with the Unitwin powerplant developed by the Menasco Mfg. Co.

Harlow Aircraft Co. has recently been formed under the presidency of J. B. Alexander, with Max B. Harlow as general manager, John C. Kelley, vice president in charge of sales, W. P. White, treasurer, and H. F. Keenan, chairman of the board. Reportedly financed in the amount of $1,000,000, the Harlow company is starting production in a 28,000 ft. hangar located on Alhambra Airport. Harlow aircraft will include the present four-place cabin monoplane and a new two-place tandem all-metal trainer.

At least six other airplane or aircraft equipment manufacturing companies are now in various stages of formation, with several due to reach the financing stage shortly.

Douglas Sales at $28,347,474

ROLLING to new records in production and earnings for the fiscal year ending November 30, 1938, the Douglas Aircraft Company has announced net profits for the period of $2,147,392.10 after all charges, which is equal to $3.76 per share on the 570,683 shares of stock outstanding. Sales for the year totalled $28,347,474.03, compared with $20,950,361.39 in 1937. This is believed to set a new all-time high for aircraft production in peace-time by any one manufacturing unit. Experimental expenditures written off against income totalled $1,444,077.18 and the company still carried deferred experimental expenses of $1,211,791.80 on its balance sheet as of Nov. 30th. Of this amount $732,459.57 was charged against the DC-4, which will represent an investment, when ready for service testing, of more than $2,363,000. Current assets as of Nov. 30th were $8,757,337.92 compared with current liabilities of $2,129,332.63. The company distributed dividends of $3 a share on Nov. 24, 1938, the first dividend payment since September, 1935. Douglas is currently employing approximately 6,000 persons. William H. Lewis and F. W. Conant will be nominated for election to fill vacancies on the board of directors at the annual meeting March 15th according to notices mailed to stockholders.

Lockheed Doubles Deliveries

LOCKHEED production and earnings are increasing at a pace approximating that of the speed of Lockheed's latest twin-engine 400 mph pursuit, according to figures contained in a recent statement. Lockheed sales for 1938 totalled $10,274,503 against 1937 sales of $5,209,986. Profits for 1938 were $442,111, equal to 66.9 cents a share, or more than three times the 1937 earnings of 21 cents a share. Backlog of unfilled business as of Dec. 31, 1938 was estimated at $33,330,586 and is known to have increased sharply since that time as the result of new British orders, probably placing Lockheed's total backlog at a new all-time high for any aircraft firm in peace-time history. Contracts under which Lockheed is now working call for delivery of almost 300 planes to foreign countries alone. No mention is made of production orders on the sensational new Lockheed pursuit. Test flights were made recently on the Lockheed 212, a light bomber version of the Model 12 commercial transport. This plane is being built, under a contract for ten, for the Netherlands East Indies, and is likely to prove popular elsewhere due to its top speed of better than 250 mph. Lockheed is known to be working currently on a major engineering program but details are not yet available for publication. A number of new planes are under development and extensive flight and wind-tunnel research work is being conducted on present models. A novel wing tip slot arrangement is reported about ready.

Mid-Continent Buys First Vega

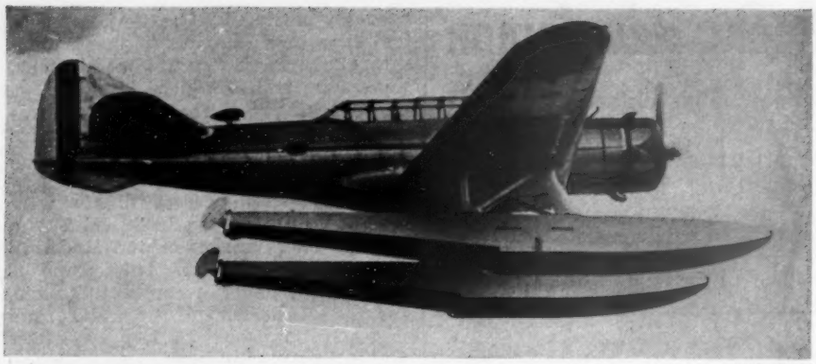
VEGA AIRPLANE COMPANY has announced the sale of its first plane in a statement by Mac Short, president. The new plane, to cost approximately $30,000, will go to Mid-Continent Airlines, of Kansas City, early this summer, and will be used for passenger service on the northern part of the Mid-Continent system. The Vega will carry five passengers and operate at a normal cruising speed of 184 mph. It is of all-metal construction, of low-wing cantilever monoplane type, with retractable tricycle landing gear, and is powered with the new Menasco Unitwin powerplant rated at 590 h.p. for take-off.

Dutch Army Places Orders

CLOSE on the heels of the announcement early in March that Holland had purchased twelve twin-engine light bombers from the Lockheed Aircraft Corp., for a figure reported in excess of $700,000, it was announced that the Netherlands was negotiating contracts with Douglas Aircraft Company for purchase of eighteen single engine attack-bombers. The planes will be similar to the Northrop attack planes now used by the U. S. Army air corps, but will be even more heavily armed. Total amount of the contract, with spares, was expected to approximate $700,000. The planes will be manufactured in the El Segundo plant of the Douglas Aircraft Company.

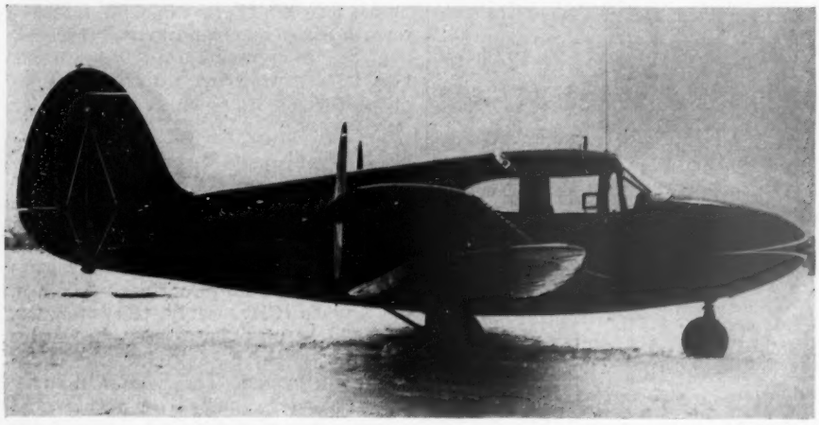
Big Contract to Wright

WRIGHT AERONAUTICAL CORP., has received a $4,857,583 contract from the War Department for their type R-1820 engines. The engines are for installation in single, bi-motored, and four-motored planes now being manufactured, as well as to provide spare engines for these planes. It is estimated that the order called for between 100 and 130 engines.



Wide World

TEST FLOWN: The new Vultee 3-place torpedo plane converts quickly to a land bomber.



Wide World

TEST FLOWN: The new 4-place Miller mounts two 125 hp. Menasco's, makes 175 mph.

S.A.E. To Hold World Congress

A COAST-TO-COAST World Automotive Engineering Congress of the Society of Automotive Engineers will open in New York on May 22 for a 5-day session; will be in Indianapolis May 29 to 30; in Detroit May 31 to June 2; and will close with a 3-day session in San Francisco, ending June 8. Of the 60 technical papers to be presented, 18 will be on aeronautic subjects, of which ten will be presented by European authorities who are making a special trip to appear before the Congress. Visitors will include Major R. H. Mayo, of Mayo Composite Aircraft Co., England; Otto J. Merkel, German authority on helicopters; Dr. Ing. W. P. Ricart, and Dr. Ing. Sandro Sirtori, Alfa Romeo design engineers from Italy; E. W. Hives, Rolls-Royce, England; R. J. Nebesar, Avia, Czechoslovakia; G. Gabrelli, Fiat, Italy; Dr. Ing. H. Altwicker, I. G. Farbenindustries, Germany; F. R. Banks, Ethyl Export Corp., England; F. W. Achterberg, Junkers Corp., Germany. Americans who will give papers on aeronautical subjects include E. T. Allen, Boeing Airplane Co.; Erle Martin, Hamilton Standard Propellers; D. W. Tomlinson, Transcontinental & Western Air; Arthur Nutt, Wright Aeronautical Corp.; A. E. Raymond, Douglas Aircraft Co.; R. J. Minshall, Boeing Airplane Co. The program has been developed by the Meetings Committee, of which Ralph R. Teetor, Perfect Circle Co., is chairman. Dr. George W. Lewis of the N.A.C.A. is on his committee. Hon. Edward P. Warner and Arthur Nutt will act as chairmen at the New York session; Capt. E. V. Rickenbacker will be toastmaster at the Indianapolis Pre-Race Banquet.

A National Aeronautic Meeting, sponsored by the Society of Automotive Engineers and its Washington Section, was held at the Hotel Washington, Washington, D. C., on March 16 and 17. The program included an inspection trip of the Engineering & Research Corp. plant at Riverdale, Md.

So Will I. Ae. S.

THE INSTITUTE OF THE AERONAUTICAL SCIENCES will hold an International Congress of the Aeronautical Sciences during the week of September 11, in connection with an aviation celebration at the New York World's Fair. Leading countries of the world interested in the advancement of aviation will be invited to send delegates, and a banquet in honor of the foreign guests will be held on September 11, at which a tribute will be paid to the Wright Brothers. Technical papers will be presented during the week.

Toward International Standards

AT A MEETING held in the offices of the American Standards Association, the principal aeronautical organizations in the country decided to take part in the development of international standards in the aeronautical field. Plans included agreement on sizes and specifications for the more commonly used parts of airplanes and engines, and also fuel specifications, and will be carried out by the International Standards Association. It was recommended that the American Standards Association organize a committee of all groups represented at the conference, to insure American participation in the international work, such committee to work under the technical leadership of the S. A. E. It was further decided that a small international conference on the subject of aircraft standards be arranged to take place in New York in May. The following organizations expressed their intention of participating in the work: Aeronautical Chamber of Commerce, Air Transport Association of America, American Petroleum Institute, American Society for Testing Materials, Civil Aeronautics Authority, Cooperative Fuel Research, National Advisory Committee for Aeronautics, Society of Automotive Engineers, U. S. Army, U. S. Navy.

Timm in Production

TIMM AIRCRAFT CORP. is now installed in its new plant on Los Angeles Metropolitan airport, Van Nuys, Calif., and is in production on small metal parts for the Model One-Sixty, a training type recently tested at Wright Field, according to an announcement by R. A. Powell, vice-president.

Brown Joins Havens

BECKWITH HAVENS, Fairchild distributor for the northeast, with headquarters at Roosevelt Field, L. I., has appointed Archibald M. Brown, Jr. as assistant. Mr. Brown has been associated for a number of years with Edo Aircraft Corp., and is executive secretary of the Seaplane Flying Association.

Gassner Enters Field

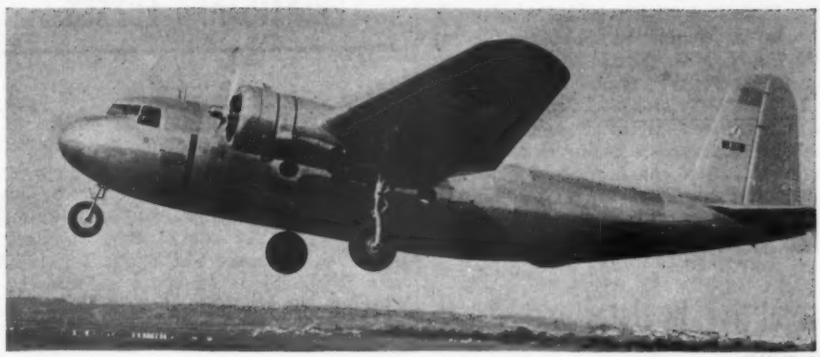
THE THOMAS GASSNER COMPANY, INC. of Wayne Ave. and Apsley St., Philadelphia, has announced the sale of 14 gear boxes, to be used in connection with the retracting mechanism of the landing gear and the mechanism for operating the flaps on the Bell Model 8. The Gassner Company has been in

the machining and metal-forming business in Philadelphia for over 100 years. They now solicit orders for all types of metal aviation parts.

Solar to Expand

PRESSURE of a record backlog of unfinished business, and anticipation of increased business due to military aircraft manufacturing activity, have necessitated expansion of the manufacturing facilities of Solar Aircraft company, San Diego, according to a statement by Edmund T. Price, president. The immediate construction of a plant addition which will more than double the present area devoted to the manufacture of stainless steel exhaust manifolds, is planned. This expansion also includes purchase of a substantial quantity of plant equipment, including lathes, milling machines, punch presses, die making equipment, welding equipment, and miscellaneous tools and other items.

Simultaneously with the announcement of the factory expansion, it was revealed that Charles F. Timms, for two and a half years with the engineering department, has been advanced to the post of factory engineering representative and will join Mr. W. K. Wheeler at the New York office to provide more intensive service for eastern aircraft manufacturers.



Wide World

TEST FLOWN: The new 16-passenger DC-5 has been performing brilliantly.

Wide World

TEST FLOWN: The new Lockheed-212 is a bomber version of the Lockheed-12.

What it is: A complete Surface Weather Indicator.

What it does: Depicts Wind Speed, Direction, Air Temperature, and Pressure . . . indoors . . . instantly and directly.

Where it applies: To airport control towers and waiting rooms, yacht clubs, public buildings, scientific and industrial weather applications and to the exceptional private home.

What it costs: $465.00—complete with outdoor Transmitter (single indicators—$25.00 up).

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Represents Budd in West

HAL P. CURTIS of Los Angeles has been appointed western representative of the Edward G. Budd Manufacturing Co. The company, which has expanded its aircraft division for the production of airplane assemblies of stainless steel, maintains a service department in Los Angeles and is considering the advisability of organizing a branch plant in California. Its main plant is in Philadelphia, with branches in Detroit.

Agent for Resistoflex

RESISTOFLEX CORPORATION of New York City has appointed as its representative for Michigan, Copeland-Gibson Products Corp. of Detroit. The Detroit firm is responsible for the sales and servicing of Resistoflex products, fabricated of Resistoflex PVA, a flexible, synthetic, new resin.

Canadian Car in Mex Deal

HOWARD F. KLEIN, executive representative of Canadian Car & Foundry Company, Ltd. announces that his company had entered into a partnership with Mexico whereby that country will manufacture airplanes to supply her own needs and to sell to other countries of Latin America. Figures were not disclosed, but it was stated that no oil or exchange or barter was involved in the contract. Mexico is to contribute the factory building, and the Canadian company the machinery and skilled personnel. Mr. Klein expected production to begin in March, with an initial capacity of three planes a week. The Canadian contract calls for the construction of 40 modified Grumman military two-place fighters, and ten training ships for the Mexican air force. Mr. Klein said that raw materials would be imported from the United States, as well as propellers, motors and instruments. He added that all the regulations of the State Department regarding sales prohibited under the Neutrality Act would be observed. The Mexican Government is to receive 50 per cent of the profits on all export business. The present strength of the Mexican Air Force is about 170 pilots and about 70 planes.

Exports Stay Up

THE BUREAU of Foreign & Domestic Commerce announces that exports of aeronautic products from the U. S. during January, 1939 amounted to $4,892,218, an increase of 53 per cent over January, 1938 which totalled $3,190,281. Aircraft represented the largest item, amounting to $2,545,922 or 52 per cent of the total; followed by parts and accessories valued at $1,073,883 or 22 per cent. Engines represented 12 per cent; engine parts and accessories 9 per cent; instruments and parts 3 per cent; parachutes and parts 2 per cent.

PROFITS AND LOSSES

» AERO EQUIPMENT CORP., for year ending Dec. 31, 1938, net profit of $164,052 against $261,799 for 1937.

» AERO SUPPLY MANUFACTURING CO. INC., for year ending Dec. 31, 1938, net profit of $109,425 or 21 cents a share on Class B stock; net profit for 1937 was $236,058, or 52 cents a share on Class B stock. Net sales were $1,069,774, against $1,411,803 the preceding year.

» AIR INVESTORS, INC., as of Dec. 31, 1938: net asset value of 23,600 convertible preference shares was $47.48 a share, against $39 a share for 1937. Convertible preference stock is preferred, upon liquidation of company, to extent of $40 a share. After preference allowance, indicated net asset value of the 203,534 common stock shares was about 86 cents each. Securities carried at cost of $1,383,780 had aggregate market value of $1,131,325 at Dec. 31, 1938. At Dec. 31, 1937 securities carried at cost of $1,333,307 had aggregate market value of $920,550.

» BELLANCA AIRCRAFT CORP. AND SUBSIDIARY: For year ending Dec. 31, 1938, net profit of $172,645 equal to 99 cents each on 174,759 shares of $1 par capital stock. Compares with $120,265 or 69 cents each on 174,750 shares of capital stock in 1937.

» BENDIX AVIATION CORPORATION, for year ending Dec. 31, 1938, net consolidated income of $156,048, equal to 7 cents a share on the capital stock. Compares with $2,255,133, or $1.07 a share in 1937. Sales for the year declined to $30,893,546 from $40,594,629 in 1937.

» BREEZE CORPORATIONS, INC., for year ending Dec. 31, 1938, net profit of $135,367 or 42 cents each on 320,523 shares of $1 par common stock; against net profit of $93,501 in 1937.

» CONSOLIDATED AIRCRAFT CORP., for year ending Dec. 31, 1938, net profit of $1,535,110, equal, after dividends on $3 preferred stock, to $2.55 a share on 574,760 shares of common stock. Compares with $462,959 or 68 cents a common share in 1937. Net sales of planes and parts for 1938 were $12,245,067, against $11,907,493 in 1937. Backlog at end of 1938 amounted to $2,796,881, compared with $13,990,096 a year ago. New business booked during past year totaled $1,051,853, against $7,771,542 in 1937.

» CURTISS-WRIGHT CORPORATION, for year ending Dec. 31, 1938, consolidated net profit of $3,598,739, compared with $1,983,609 for preceding year. Shipments and operating revenues for 1938 were $33,102,962, against $24,116,084 in 1937. Backlog was $31,546,521 on March 3, 1939, compared with $29,455,345 on March 4, 1938.

» DOUGLAS AIRCRAFT CO. INC., AND SUBSIDIARY, for fiscal year ending Nov. 30, 1938, net profit of $2,147,392, equal to $3.76 each on 570,683 shares; compared with net of $1,081,513 or $1.90 a share for preceding year. Net sales for 1938 fiscal period were $28,347,474, a 35 per cent increase over 1937. Bank loans of $5,230,000 were fully paid during 1938.

» GRUMMAN AIRCRAFT ENGINEERING CORP., for year ending Dec. 31, 1938, net income of $617,074, equivalent to $1.30 each on 473,060 shares of capital stock. Compares with profit of $139,061, or 32 cents each on 431,865 shares in 1937. Sales increased to $4,904,945 from $2,284,764 for 1937. Backlog for the 1938 period was $3,500,000 against $3,250,000 for the preceding year. Floor space was increased by 10,000 sq.ft. during the year.

» LOCKHEED AIRCRAFT CORP., for year ending Dec. 31, 1938, net income of $442,111, equal to 67 cents each on 660,879 shares of capital stock; for 1937, net income of $137,919 or 21 cents each on 659,213 shares. Net sales for 1938, $10,274,503, against $5,209,986 in 1937.

» NORTH AMERICAN AVIATION, INC., for year ending Dec. 31, 1938, net profit of $1,904,085, equal to 55 cents each on 3,435,033 shares of capital stock; compared with net profit of $496,103 or 14 cents a share for 1937. Company received $998,455 in excess of book value from sale of securities, including sale of its air transport operations. Unfilled orders at Dec. 31, 1938, were $10,914,528, against $9,301,126 at Dec. 31, 1937.

» RYAN AERONAUTICAL CO. AND SUBSIDIARIES, for year ending Dec. 31, 1938, net income of $23,602, equal to 8 cents each on 300,000 capital shares; compared with $16,370 or 6 cents each on 259,650 shares in 1937. Net sales, $444,373, against $290,902 in 1937.

» SOLAR AIRCRAFT CO., net sales for 40 weeks ending Feb. 4, 1939, $446,675. Net profit, $33,687, equal to 14 cents each on 225,446 shares. Unfilled orders amount to more than $240,000.

» UNITED AIRCRAFT CORP., AND SUBSIDIARIES, for year ending Dec. 31, 1938, net profit of $5,426,275, equal to $2.12 a share on capital stock. Compares with $3,856,272 or $1.52 on 2,531,296 shares of stock in 1937. Sales during 1938 totaled $35,716,638, a 25% increase over 1937.

» WARNER AIRCRAFT, for year ending Dec. 31, 1938, net profit of $8,407 or 2 cents a capital share. Compares with net loss of $11,323 for 1937.

AIR TRANSPORT AVIATION

TCA Starts Montreal-Vancouver Mail

Passenger Service to begin April 1

TRANS-CANADA AIR LINES inaugurated a regular daily air mail service between Montreal and Vancouver on March 1. Westbound planes leave Montreal at 9 p.m. and arrive at Vancouver at 11:35 the following morning. Eastbound mails leave Vancouver at 6:45 p.m. reaching Montreal at 12:50 p.m. the next day. Intermediate stops include Ottawa, Toronto, North Bay, Winnipeg, Regina, and Lethbridge. Planes from Calgary and Edmonton connect with the main line at the latter point. There are two round trips daily between Lethbridge, Calgary, and Edmonton. Prairie Airways makes connections at Regina serving Moose Jaw, Saskatoon, Prince Albert, and North Battleford.

Passenger service is scheduled to start April 1. Rates, according to Mr. George G. Wakeman, General Traffic Manager, are to be about six cents a mile. These fares will be comparable with those on United States air lines. Round trip rates will be double the one way fare less ten per cent. Children under two years of age, when carried in arms, will be carried free. Children over two and under eleven will travel at half fare. There will be no additional charge for refreshments served aloft. Forty pounds of baggage will be allowed per passenger, and excess baggage will be charged one half of one per cent of the adult one-way fare per pound.

Expenditures at the end of 1938 for Canada's Airways and Airport Construction as given by the Minister of Transport are:—

Civil Aviation	$7,842,056.27
Aviation Radio	1,529,400.00
Meteorological Services	35,866.49
Grand Total	$9,407,322.76

Trans-Canada Air Lines Corporation does not own any airport. It has leased hangar space and airport facilities from Vancouver, Cranbrook, Edmonton, and Regina. It has leased the Lethbridge Municipal Airport from the city and erected a hangar, but remains responsible to the city for the airport's administration. The Company has leased ground and erected a hangar at Winnipeg and arranged for the lease of landing facilities.

American Still Gaining

ACCORDING to Charles A. Rheinstrom, vice-president in charge of sales for American Airlines, revenue passengers during February increased 20.4 per cent over the corresponding month during 1938. The total for the month was 20,881. Revenue passenger miles flown increased from 7,526,570 in February 1938 to 8,853,752 during February 1939—a 17.6 per cent gain.

All American Ready to Go

FIFTY-FOUR cities and towns in Pennsylvania, West Virginia, Ohio, and Delaware will be linked for the first time with the national air mail system, when All American Aviation, Inc., begins regular operation of its new air mail pick-up and delivery system on May 12. One of the two routes will operate between Wilmington and Pittsburgh serving 27 cities and towns all of which, with the exception of Wilmington, are in Pennsylvania. The other route is between Pittsburgh and Huntington, W. Va., serving 27 cities and towns in Southwestern Pennsylvania, West Virginia, and Southeastern Ohio.

The Post Office Department recently awarded All American contracts for carrying the mail over these routes by the use of the unique pick-up and delivery system developed by the company and invented by its vice-president, Dr. Lytle S. Adams.

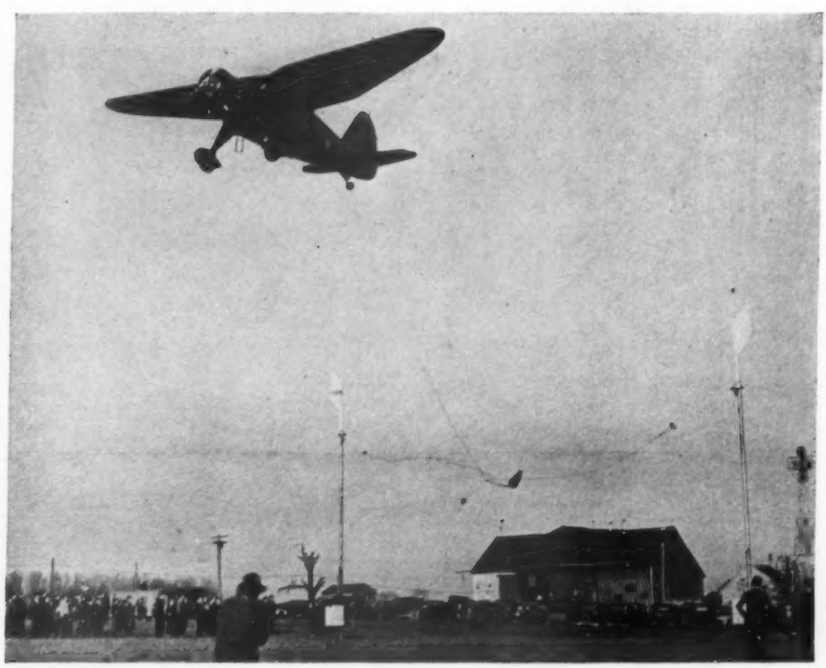
Officials of All-American Aviation, including Richard C. du Pont, president, and Dr. Adams, will soon visit each town along the route to confer with local Post Office and municipal authorities on the selection of a site for the pick-up station, the installation and servicing of equipment, and development and improvement of service consistent with the needs of the community.

Northwest Tests Inhalators

A NON-STOP high altitude flight was made by Northwest Airlines from Minneapolis to Boston on March 10. The flight was made at altitudes ranging from 20,000 to 30,000 feet in one of Northwest's Lockheed 14H transports equipped with the new oxygen equipment designed and perfected for aircraft use by scientists of the Mayo Fundation of Rochester, Minn. The purpose of the flight was to demonstrate the equipment in actual use over long distances at substratosphere levels, as well as its use in regular commercial flight at normal altitudes.

Among the passengers were Doctors W. M. Boothby, W. R. Lovelace, and A. H. Bulbulian who have directed the work of developing the oxygen apparatus. Dr. Lovelace has made several high altitude flights on Northwest ships during this work. Among these was a

(*Turn to page* 62)



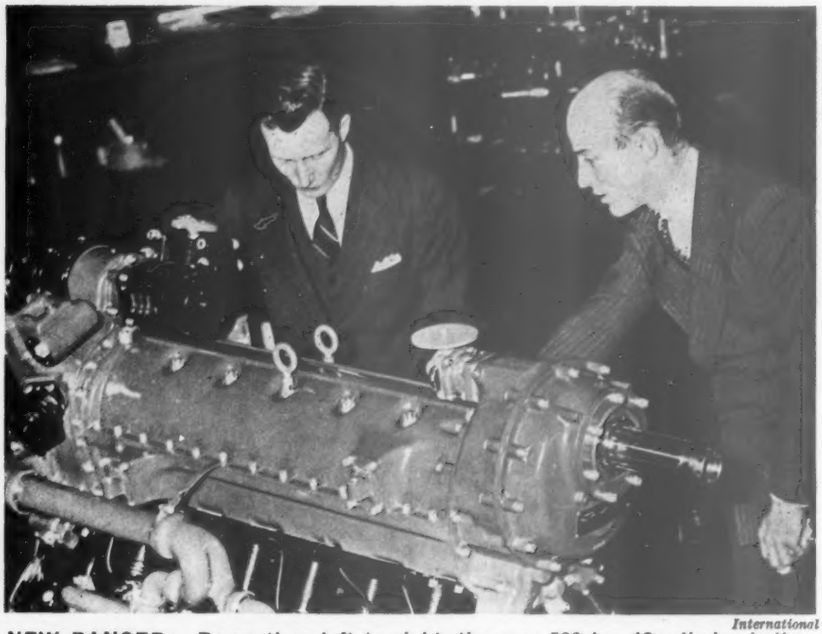
MAIL SNATCH: An All American Stinson demonstrates latest pick-up technique.

AVIATION PEOPLE

Who's Who in This Month's News

MEDALIST: Leslie L. Irvin, awarded one of the Royal Aeronautical Society's most cherished medals—for his work with "air-chutes," of course.

TRAVELER: K. S. (Slim) Lindsay, export sales manager for the B. G. Corporation has sailed for Europe, Asia and way points.



International

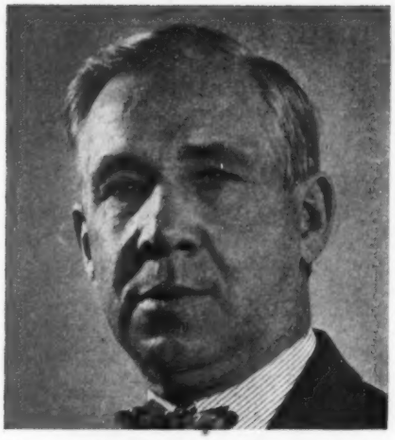
NEW RANGER: Presenting, left to right, the new 500 hp. 12-cylinder in-line air-cooled Ranger; William J. Carry, Sales and Service Manager of the Ranger Engineering Corporation; Duncan B. Cox, Vice President and General Manager of that company. Said to be the lightest per horsepower of its type ever developed, the new Ranger has already produced much interest from U. S. military and naval experts and from manufacturers of transport equipment. The company has disclosed it is also pushing development on a much larger unit.

FLYING ADMIRAL: Late in 1911 a young Lieut. John H. Towers, U.S.N., qualified for his F.A.I. license, thus became the third Naval Aviator in America. Thereafter he helped organize the first flying school at Pensacola. He was assistant to the director of Naval flying during the war. He commanded the flight of the NC boats. He has twice been Assistant Chief of the Bureau of Aeronautics. Last month he was named Chief.

HARLOW AIRCRAFT—left to right, above: J. C. Kelley, Jr., Vice President Sales; M. B. Harlow, Vice President and Manager; J. B. Alexander, President.

STYLE NOTE: Capt. and Mrs. Mal B. Freeburg (He's Northwest's eastern Division Superintendent) demonstrate the new B.L.B. Inhalators.

Acme



ALL AMERICAN: Above, Dr. Lytle S. Adams, inventor of that air line's unique pick-up mail system and its vice-president. Below, Richard C. DuPont, President.

SATISFIED CUSTOMER: Capt. H. G. B. de Kruyff Van Dorssen, representative of the Netherlands East Indies Government and Glenn L. Martin pose in front of the 100th airplane to be delivered to Royal Netherlands East Indies Air Force from the Martin factory in Baltimore. As a matter of fact a Martin plane was the first ever purchased by that air force, in 1914.

HONORARY FELLOW: Major Lester D. Gardner, (left) Secretary of our own Institute of the Aeronautical Sciences, and one of those most responsible for its existence, was last month properly honored. The Royal Aeronautical Society picked him as Honorary Fellow—the third American ever so named.

flight to test earlier equipment last August. This flight was from Los Angeles to Minneapolis and reached an altitude of 31,400 feet. Altitude flights were also made at Minneapolis on February 20 and at Chicago on February 22, when newsmen and doctors were taken up for a demonstration of equipment.

Fair Helps W.A.E.

WORLD'S FAIR TRAFFIC is already being reflected in sharp travel increases over the Western Air Express system, according to an announcement by Tom Wolfe, vice-president in charge of traffic. According to a report issued by Wolfe February, 1939, revenue passenger miles increased by ten per cent to a new high of 421,565, as compared with 382,188 in February, 1938.

Your Berth is Ready

A NEW SLEEPER SYSTEM, similar to set-off sleepers on railroads, has been arranged at Kansas City and Chicago, whereby passengers aboard sleeper planes will be allowed to remain in their berths until the take-off of through planes for Los Angeles and New York. In New York and Kansas City passengers on sleeper planes arriving at an early hour will be allowed to remain on the ships up to an hour after scheduled arrival.

United Gains in West

UNITED AIR LINES has announced that since the opening of the San Francisco Fair, traffic on its Pacific Coast route has increased 26 per cent. This resulted in an increase in schedules over the system to 1,300,000 miles a month, exclusive of extra sections which are flown as the traffic demands.

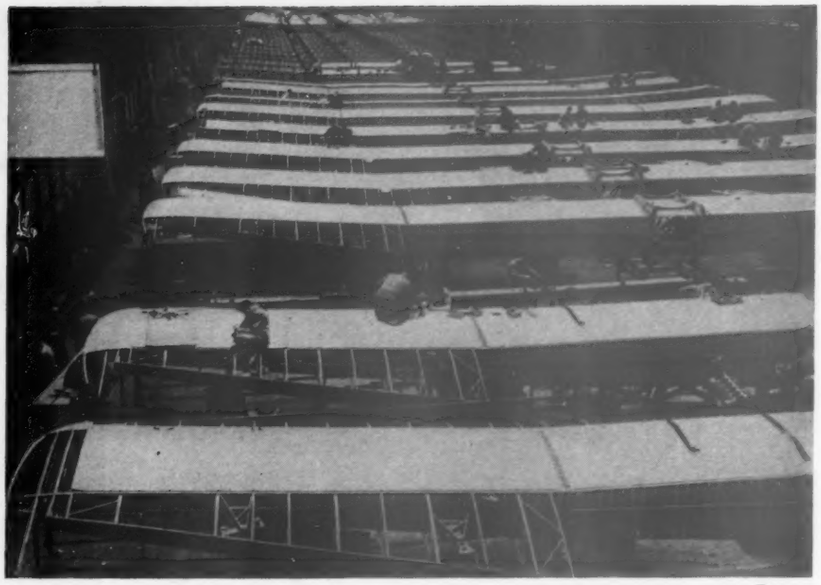
AIR TRANSPORT INDICATOR

March 1, 1939

118.7

Which is the ratio of the revenue passenger miles reported by the Air Transport Association as carried by all domestic airlines during February, 1939, to the corresponding figure for February, 1938.

The year continued its good start with a total for two months of 65,504,202 passenger-miles as compared with 57,250,000 for 1938.



European

BRITAIN'S WINGS GROW—FASTER: Recent view of assembly line in Armstrong-Whitworth factory

AVIATION ABROAD

The British are feeling better these days since the word is out that by the first of April they'll have 1,750 first-line planes in the Metropolitan Air Force. The best thing about it is that it means the expansion schedule set last spring is being held. According to the plan announced then the goal is 2,370 first-line ships at home plus around 1,000 overseas and with the fleet by March 1940, but the talk around London after the Crisis last fall was that these figures were to be upped considerably. One thing that cheers the British is their guess that their production rate is drawing up on Germany's, and according to Sir Kingsley Wood it's doubled in the last year and is still going up. He even has hopes of seeing it double again this year. This checks fairly well with the fact that the budget figure for new aircraft this year (around $420,000,000) is just about twice last year's. The big question is too much of a military secret to be answered—how many modern ships are being placed in reserve over and above the announced first-line strengths. . . . The job of untangling the Fleet Air Arm and getting it turned over to the navy is progressing slowly, and in some respects is going to stop about half way to avoid gumming the works with too many changes during the Great Expansion. The Air Ministry will continue to handle all primary training, turning pilots over to the Admiralty for advanced flying. It will also train the seagoing mechanics and handle all aircraft procurement, which is supposed to keep the two services from fighting over who gets its planes built first. . . . The English announcements didn't bother General Goering, who said Germany would maintain her lead in the air no matter what and called for "planes in numbers and of a quality that seem unthinkable." The news is out that the Germans have also taken up balloon barrages, but they're evidently going at it in a little different way from the English, who concentrated them around London first and are now extending them to other big cities. The German plan seems based first of all on establishing air defense zones about thirty-five miles wide just behind the frontiers, and concentrating a big part of the defense forces—fighters, anti-aircraft, and balloons—up there as a sort of aerial Maginot Line. Behind these come the defenses around important centers, but the Germans apparently put more trust than other countries in being able to fight off raids before they reach their objectives.

The French found time somehow to do a little export business in 1938. In the first eight months they shipped about $2,400,000 worth of aircraft and parts, the biggest end of it going to Yugoslavia, Rumania, and Greece. . . . Italy managed to sell 153 ships abroad in 1938, worth about, 40 per cent over 1938 exports. She recently muscled into what had been strictly British territory by selling four Savoia-Marchetti bombers to the Iraq Air Force. . . . That deal between Canadian Car and Foundry and the Mexican Government for a Mexican plant looks as if it's finally

HARLOW SCOOPS THE INDUSTRY

NEW PRIVATE ALL METAL TRANSPORT KNOCKS INTO A COCKED HAT EVERY PRECONCEIVED NOTION ABOUT PERFORMANCE!

Performance never before approached by any commercial airplane, the Harlow cruises at 160 miles per hour and delivers 17 miles to the gallon of gas with its 145 h.p. Warner engine. Coupled with economy of operation which would have been unbelievable had it not been so clearly demonstrated, instantly stamps the newcomer as the standard by which all future commercial airplanes will be judged. The flying characteristics of the Harlow are unexcelled. Controls are aero-dynamically and statically balanced and fitted throughout with ball bearings making it the most effortless airplane to handle either in the air or on the ground.

In flight it [illegible] speed [illegible] latest [illegible] second [illegible] supreme [illegible] one [illegible] cost [illegible] all [illegible] ventilation [illegible] traceable [illegible] speed [illegible] cruising [illegible] get [illegible] operation [illegible] those who [illegible] minimum [illegible]

Only the Beginning

And that's only the beginning. This marvelous craft is equipped with a fully retractable, electrically operated landing gear, raised or lowered in six seconds. The specially designed, electrically operated flaps reduce landing speed to 48 miles, and with the aid of hydraulic brakes bring the ship to a full stop in 240 feet.

Speed and Economy

Cruising at 160 m.p.h. with four persons and luggage, the 35 gallon tank carries sufficient fuel for 600 miles of cross country flight.

And There You Have It

When Harlow engineers started work on this design they had only the superlative in mind. It must possess supreme airworthiness, high cruising speed, unusual economy and low first cost. It must have "automobile comfort", low speed landing characteristics and a gas capacity of at least 500 miles. In appearance it should resemble the latest transport planes. How far these minimum specifications have been exceeded can only be truly appreciated by those who see and fly the ship.

Air Conditioned and Automobile Comfort in the Air

The new all metal Harlow cabin, built to the lines of a popular two door sedan, provides lounging comfort for four persons. Ample luggage space is found in a separate compartment.

Wide windows and a large windshield give exceptional vision in all directions. Perfect ventilation is obtained by bringing fresh air through conduits from the leading edge of the wing.

Two of the best known sound proofing engineers have collaborated in reducing the sound level of the Harlow cabin to less than that of the latest commercial transports.

Low Power, High Performance

The Harlow is powered with the Warner Super Scarab radial engine which develops 145 h.p. at 2050 r.p.m., but owing to strikingly clean design of the Harlow with its retractable landing gear and the absence of exposed brace wires, struts or accessories, it easily outdistances ships exceeding it in power as much as 50 percent. In addition to the highly efficient Harlow this popular engine delivers greater performance than has been accomplished by any of [illegible] rating. At the same time, superb efficiency is reflected in the, [illegible] unheard of, economy and [illegible] cruising range, a range [illegible] frequent service stops [illegible] any of

Announcing the

HARLOW

Private Transport

ALL METAL

A four-place cabin plane built to commercial transport standards.

AUTOMOBILE COMFORT

At last a private airplane with a cabin patterned after a sedan.

160 M.P.H. CRUISING

. . . and this with a Warner 145 h. p. engine.

17 MILES PER GALLON

. . . and a range of 600 miles.

$6,985

Complete F.O.F. Alhambra

PRICE SUBJECT TO CHANGE WITHOUT NOTICE

HARLOW AIRCRAFT COMPANY

Alhambra Airport, Alhambra, California

Write for name and address of your nearest Harlow dealer

been put through. The Mexicans are to furnish the factory and the Canadians the machinery and supervision, while most of the material will come from the U. S. After the initial order of forty fighters and ten trainers is turned out, the Mexicans are expected to go out hunting some export business of their own.

Prize distribution day at the Royal Aeronautical Society brought out some interesting awards. Major Mayo drew the silver medal for his piggyback work—the landplane version to take off the back of an Ensign and cruise at 270 mph. is now under construction. Squadron Leader Fraser took the Taylor gold medal for a paper on high wing loadings from the pilot's standpoint, while one on the same problem as it affects takeoff brought H. F. Vessey a share of the Buck Memorial Prize. The Wakefield gold medal for safety contributions went to Leslie Irwin for his parachutes. Papers by Squadron Leader Buxton on sailplane development, H. E. Rochefort on stressed skin construction, and P. H. Rayner on engine research completed the list.

The twentieth anniversary of the London-Paris service will see British lines stepping up their schedules to eight round trips a day and making preparations for a lot of business. D. H. Frobishers, the short range passenger carrying version of the Albatross, will do most of the hauling. They've been busy lately setting a lot of point-to-point records over Imperial's European lines. . . . The Australia-New Zealand line has come along to the point of naming captains for the three super-Empire boats that are to go on the run, and the boats themselves are due for launching. The next step on this route will be an extension of 1,300 miles to Fiji, which would put a British trans-Pacific line pretty well on its way across. . . . The Champion, the super-Empire boat going across to replace the Cavalier on the Bermuda run, will make a survey flight from Bathurst across the South Atlantic to Brazil and on up through the British West Indies on the way over. . . . The first flight was made over the Chunking-Rangoon line to be operated jointly by China National Aviation Corporation and Imperial Airways, but real service has been postponed a few months until intermediate fields are improved enough to take the DC3s that CNAC intends to use. Meanwhile CNAC is surveying another tie-up with the main airline map at Hanoi, and is dickering with the French Indo-China government for rights to run a regular service.

The Italians boosted their airline statistics considerably for the year 1937-1938, in line with the general expansion of their interests around the Mediterranean. Ala Littoria, which handles most of the internal and foreign business, flew about 7,000,000 miles, over routes that increased from 12,500 to 17,000 miles during the year. New Lines were added in eastern Europe, along the south coast of the Mediterranean, in General Franco's part of Spain, and also in the new African territory. During the year they carried around 120,000 passengers, 550 tons of mail, and 850 tons of express. At the end of the year they had a fleet of 59 landplanes and 40 seaplanes, 22 of which were scheduled for early replacement by more modern types on order. Around 56 per cent of the gross take came from subsidy, paid at the rate of 48 cents per airplane mile. . . .

MILITARY AVIATION

Towers to Head Bureau

AMONG the 14 Navy Officers appointed to high command as announced March 15 by Charles Edison, Acting Secretary of the Navy, were Rear Admiral Arthur B. Cook and Captain John H. Towers. Rear Admiral Cook, who has been Chief of the Navy Bureau of Aeronautics since June 12, 1936, becomes Commander Aircraft Scouting Force. He is relieved in his former office by Captain Towers, who was Assistant Chief of the Bureau of Aeronautics. Captain Towers, on becoming chief of the Bureau, assumes the rank of Rear Admiral.

Rear Admiral Cook was born in Evansville, Ind., in December, 1881, and received his appointment to the Naval Academy in 1901. He served as Aide to Admiral Henry T. Mayo from 1913 to 1916 and, after a year's duty at the Naval Academy, from 1917 to 1919. Since 1928 when he qualified as a Naval Aviator at the Naval Air Station in Pensacola, he has had duty involving flying.

Captain Towers was born in Rome, Georgia, January 30, 1885. He graduated from the Naval Academy September 12, 1906. In 1911 he became one of the first three naval officers assigned to aviation duty, being directed to report at Hammondsport, N. Y., for flight instruction under Glenn Curtiss. In October, 1912, he established a world's record for endurance in a seaplane by a flight of six hours, ten minutes. At the outbreak of the war in 1914 Captain Towers was attached to the American Embassy in London as an Aviation Observer. He later served as Assistant Director of Naval Aviation until February 1919, when he was ordered to duty in charge of the trans-Atlantic flight of the NC seaplanes. He was made Assistant Chief of the Bureau of Aeronautics, Navy Department, on July 2, 1938.

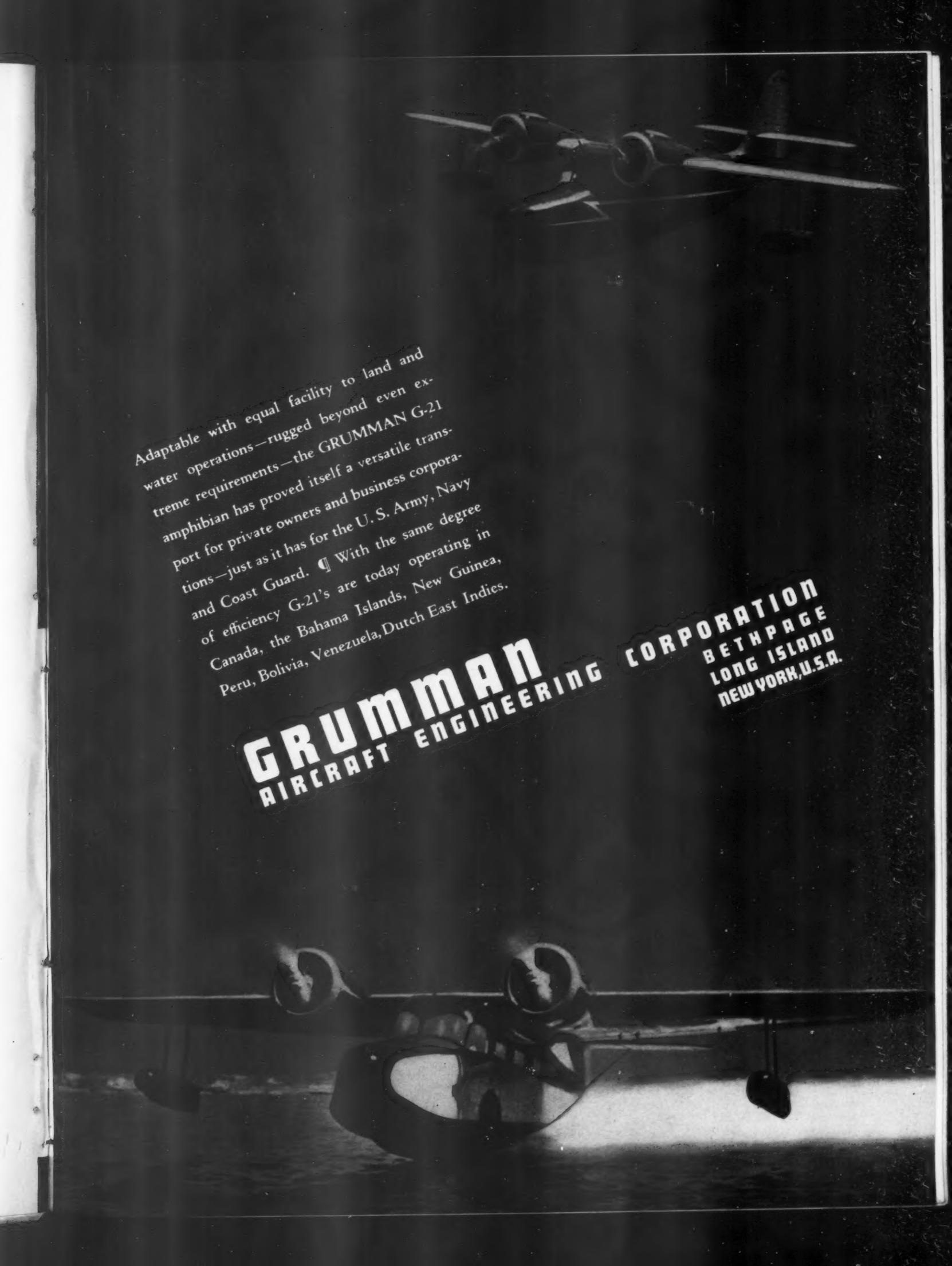
Navy Opens Zep Bids

THE NAVY opened bids early in March for its first dirigible in over ten years. Although the $1,000,000,000 expansion bill of 1938 authorized construction of a rigid airship not to exceed 3,000,000 cubic feet volume, the Navy Department, when asking for bids, specified that it was not to exceed 1,000,000 cubic feet nor 325 feet in length. Four bids were received, all from the Goodyear-Zeppelin Corporation of Akron, Ohio, as follows:—

1. Navy Design—325 feet in length, 1,000,000 cubic feet capacity. Delivery in 24 months. $1,997,482.
2. Goodyear-Zeppelin design—325 feet and 1,000,000 cubic feet. Delivery in 24 months. $1,997,482.
3. Goodyear-Zeppelin design—650 feet and 3,000,000 cubic feet volume. Delivery in 30 months. $2,940,350.
4. Goodyear-Zeppelin design—Pressure type airship. 318 feet long, 800,000 cubic feet capacity. Delivery in 18 months. $760,916.

Wide World Photo

GENERAL HEADQUARTERS' HEADQUARTERS: A view of work in progress at Scott Field, Ill. $7,500,000 will be spent to fit it to house the headquarters of GHQ Air Force.


Adaptable with equal facility to land and water operations—rugged beyond even extreme requirements—the GRUMMAN G-21 amphibian has proved itself a versatile transport for private owners and business corporations—just as it has for the U. S. Army, Navy and Coast Guard. ¶ With the same degree of efficiency G-21's are today operating in Canada, the Bahama Islands, New Guinea, Peru, Bolivia, Venezuela, Dutch East Indies.
GRUMMAN
AIRCRAFT ENGINEERING CORPORATION
BETHPAGE
LONG ISLAND
NEW YORK, U.S.A.

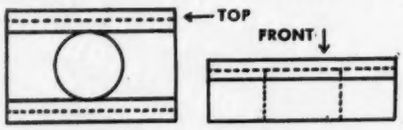
The Birdmen's Perch

HOW GOOD A LIAR ARE YOU? To every man, woman, or child in America the Birdmen's Perch offers the opportunity of testing in open competition his or her skill as a prevaricator. Simply send in the funniest yarn you can drum up about Gulf Aviation Gas. The monthly prize is a handsome diploma suitably inscribed and imprinted with a special illustration of *your* Whopper. It's the opportunity of a lifetime . . . act today!

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips,"
Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

T. W. T. PROJECT NO. 2

We certainly started something when we printed that projection problem in February. Solutions—about half of 'em right—poured in from all over creation. Plus a few dares to print a really *hard* one. O.K., chums, here it is . . . not too difficult but tougher than the first. Remember to send in your answers for the official version.



If the top and front views of an object are as drawn above, what is the side view?

COGNOSCENTI CORNER

We take great pleasure in printing a list of recent contribs to our Puzzlers Association. With a few of their more pertinent remarks thrown in for good measure.

H. F. Rogers; Rolfe "What gets me is how did he manage to count the ducks so accurately?" Olson; Al Hines; George J. Wells; Arthur F. Seymour; Irving Pearlman; David Carr; Lester Eide and Glen "In the future please use smaller numbers as it takes us too long to find so large a flock of ducks!" Jacobs; John Riehl, Ted A. Axtell, Robert Prichard; Anthony Smaldone; H. L. Thomson; M. Schroen and J. Miller.

Also, Harmon Van Winkle; George E. Nettleton, Jr.; Jerome C. Baer; Charles R. Cole; John C. Faiella; Sam "Why don't your readers send in some good ones?" Sverdlik; Paul Bates; Johnny "After going nuts . . . I took it to my instructor!" Childs; Bob Newill, John M. McKeown, Fred "How about giving us something tough to play with?" Taraschi; Sam Anglin; Eugene Conklin; Frank Furry; George "How far off am I?" Ekeberg; Neal Scott; Don E. Henry; W. I. McCurdy; Stewart "Here's one *I* thought up!" Hartshorn; John Cadman; and Kenneth "I am still working on the (September) one about the bookworm!" Reed.

THOROUGH!

You've heard the one about the retired Indian scout who lived in a cabin in the woods with his nine cats. And who had exactly nine holes cut in the bottom of the door . . . because when he said "*Scat!*," he meant "SCAT!"

Same way with the refining engineers in the plant where we make Gulfpride

from 100% pure Pennsylvania crude. Those boys don't fool around, either. Not only do they refine the oil by ordinary methods that get all the easy-to-remove dirt and sludge. But in addition they swing into action with Gulf's famous and exclusive Alchlor process that digs down still deeper . . . removes as much as 20% *more* carbon formers. When that Alchlor process says "Scat" to oil impurities, it means it, too!

THIS MONTH'S WHOPPER

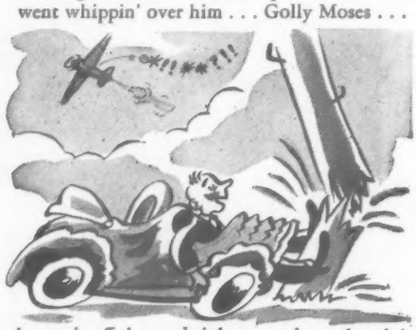
Dear Major:

You know I don't think I like your Gulf Aviation Gas on accounta' it's so good.

Was a time, before I started using it in my old crate, I could hedge-hop peacefully along a couple hundred feet up and see things happen down on the ground. Got a big kick out of it, too. Now that I'm using that dynamite juice extract o 'yourn, I only get to see them *start* to happen!

Take last Thursday: I was flyin' along quiet-like, sort o' reconnoiterin' above a lake where a lot of people was skating and I seen a man slip on the ice. But the blame alarm clock works that drive the prop were turnin' over so fast on your Gulf Aviation Gas that I passed out of sight over the horizon before he fell! Been worried ever since as to how bad he was hurt.

But the final straw cum yestiddy . . . I was hedge-hoppin' along as usual above the highway watching to see what I could spot when along cum my brother-in-law driving *my* new car. I leaned over the side to shake my fist at the mug fer takin' it without permission. As I went whippin' over him . . . Golly Moses . . .



he ran it off the road right at a telegraph pole!

Well sir, I threw that flying fortress (early Roman model) of mine into a bank so tight I thought not only the wings but my ears was going to cum off. But by the time I got 'er around not only had my nice, new, shiny car hit and demolished that telegraph pole but the wrecking car had arrived and towed the remains out o' there! (guess they musta' had Gulf Aviation Gas in the wrecker, too!)

H. O. Larson

P. S. They also had Gulf Aviation Gas in the ambulance that called around to get my brother-in-law after I finished with him. The way I know is that it got there between the time I hit him and when he started to hurt!

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**

AVIATION'S OPERATORS CORNER

Tagging the Bases with

LES NEVILLE

Cub Distributors Meet

Piper Company and Engine Makers Host to Salesmen

BALD EAGLE MOUNTAIN beamed down benignly last month on a scene unparalleled since the days when log rafts were floated down the West Branch of the Susquehanna River. It was the annual convention of Piper Cub distributors held March 14, 15, all over Lock Haven, Pa. Principal meetings took place at the Fallon Hotel, but there were visits to the plant, flights from the airport, and various other forms of entertainment for the 30 distributors and others present.

Highlights of the meeting were the announcement of price reductions and new models. Among them were a new 50 hp. Standard Trainer, a 60 hp. Coupe at $60 less than the previous 50 hp. model, and a 65 hp. Coupe. Other Trainer prices range from $1298 for the 50 hp. Standard Yellow Franklin Trainer to $1595 for the 50 hp. Lenape dual ignition model. The Trainer series now includes the Sport Models and the additional "Sport" accessories are extras. The Franklin 60 Coupe with pants, hydraulic brakes and landing gear and other additional equipment costs $1935 and the 65 hp. Continental Coupe costs $1995.

Distributors' ratings in the order of their sales were: Bennett Air Service, Hightstown, N. J.; E. W. Wiggins Airways, Inc., Providence, R. I.; Neil McCray, Erie, Pa.; Art Whitaker, Portland, Ore.; DePonti Air Service, Minneapolis; Aircraft Associates, Long Beach, Calif.; Phil Meinke, Willoughby, O.; Blevins Aircraft, Hapeville, Ga.; Tufts-Edgcumbe, Mt. Prospect, Ill.; and Camel City Flying Service, Winston-Salem, N. C.

Special commendation was won by Delbert Clayton, Davenport, Iowa, who had sold the most airplanes in proportion to the population in his territory and to Wes Marden of Waterville, Maine, who sold the second highest number in proportion to population. Columbia Airways of Bloomsburg, Pa., was also commended for taking eleventh rank at the end of their first year as Cub distributors. One new distributor was appointed, Beverly Howard of Hawthorne Flying Service of Charleston, S. C.

On the program were luncheons given by Lycoming and Franklin, a dinner by Continental, cocktail parties by Continental, Lenape, Interstate Finance, and the concluding Cub Dinner. Among the speakers were Fred Davey and Jerome Lederer, of Aero Insurance Underwriters; M. S. Hutchins, Hutchins Advertising Co.; Leighton Collins, Air Facts; Grove Webster, C.A.A.; Thomas H. Beck, of Colliers; and W. H. Piper, and Ted Weld.

College Pilots Log Hours

Purdue leads with over 500 and 17 solo students by March 11

PILING UP HOURS is the latest pastime in the 13 colleges selected for the demonstration phase of the C.A.A. Civilian Training Program. Led by Purdue, which served as a model for the plan, most of the schools got off to a good start. By March 11 Purdue had logged 516 hours and turned out 17 solo pilots. Others were close behind. An average of 25 per cent of the student bodies of the thirteen institutions applied. The University of Alabama had 1200 applicants from which to pick its 30 students.

After the student has passed a rigid physical examination and conformed to the qualifications of his college and the C.A.A. he is ready to fly. It costs him a maximum of about $70 depending on the tuition rates at his particular college. Usual breakdown is $10 for physical examination and $20 for life insurance. The remainder is for university fee and tuition fees for the required ground courses. And if he is among the late starters he will be doing plenty of flying to log his 35 hours by June.

Some dissatisfaction was expressed by unsuccessful bidders for the training contracts. A protest was registered by the Student Fliers of America at Floyd Bennett who were among more than a dozen bidders, most of whom were disqualified because of the distance of their operations from the school. At Lawrence (Kan.) Airport, Ashcraft Flying Service contested the contract awarded Robertson Aircraft Corp. on the basis that the former had exclusive operating rights on the field.

Fixed base operators to whom contracts have been awarded are: L. I. Aratz, 50 students at $250 each on Cubs (Purdue); Ann Arbor Air Service and Michigan Aeronautical Company jointly, 20 students at $250 each on Aeroncas (University of Michigan); Standard Aviation, 30 students at $245 each on Aeroncas (N. Y. University); E. W. Wiggins, 20 students at $195 each on Cubs (M.I.T.); Serv-Air, 20 students at $250 each on Cubs and Rearwins (North Carolina State College); Eastern Air College, 30 students at $200 each on Cubs and Aeroncas (Georgia Tech); Alabama Institute of Aeronautics, 30 students at $250 each on Cubs (University of Alabama); Ritchie Flying Service, 30 students at $200 each on Cubs and Fleets (North Texas Agricultural College); Monrovia Aircraft, Inc., 15 students at $150 each

Mascot: This Cub brought realism to the Piper Distributors' Convention

on Cubs, Darts, and Taylorcraft, including free transportation between airport and college (Pomona Junior College); Norman R. Breedin, 15 students at $240 each on Cubs (San Jose State College); Kurtzer Flying Service, 30 students at $220 each on Cubs and Taylorcraft (University of Washington); McInis Air Service, Inc., 20 students at $202.71 each on Cubs (University of Minnesota); and Robertson Aircraft Corp., 20 students at $247.50 on Cubs and Taylorcraft (University of Kansas).

Critics of the program included several educators led by President Wilkins of Oberlin, who charged the program was "unsound both educationally and from the point of view of national defense." Some of his sentiments were echoed by Dr. Alan Valentine, president of the University of Rochester, who felt that better use could be made of our college men in case of war. In reply C.A.A. spokesmen stated that putting men of high aptitude into military piloting was not the aim of the program, nor did they believe it would be the result. Among those educators favorable to the plan were Provost Rufus D. Smith of New York University and Rev. Robert I. Gannon of Fordham, and Edward C. Elliott, president of Purdue.

Los Angeles is a shambles in the neighborhood of Southwest Airport if we are to believe the sworn statements of prosecution witnesses in the recent legal action against the airport. Lurid stories that pilots frequently almost collided with their chimneys or roofs due to low flying, that the noise of the planes was so terrific as to cause heart trouble, disturb normal growth of children, etc., that oil and engine parts frequently fell on homes and streets of the vicinity, that dust was so bad that singers could not sing and people could not find their way home, that pilots leaned out to throw bottles or firecrackers at residents, or flirt with the housewives through shouting at them from the air were told by the witnesses. On the defense side was shown that no physical injury has been suffered by any resident of the area in thirteen years of operation of the airport, that dust from the airport was not unduly great and could be entirely eliminated through oiling runways. On the noise problem the defense conducted scientific tests with a decibel meter operated by acoustics experts and was able to show that a 50-100 h.p. airplane operating at full throttle within 100 ft. altitude of a home, made less noise than the ordiary vacuum cleaner, door bell, phone bell, kitchen mixer, and other appliances operated by the housewife.

In the course of the trial Judge Rhodes, who presided, visited the airport to witness operations in person, and took his first airplane ride as a passenger of Wm. Gage, operator of Gage Flying Service, on the airport.

Although no official decision has yet been handed down, it is understood privately that the airport will not be abated as a nuisance, but that the operators of the field will be required to control operation of planes so that none ever approaches to less than 100 ft. altitude of a home, and higher altitudes at greater distances from the field. Oiling of take-off and landing runways is also being stipulated, and aircraft are to be required to operate their engines at no distance closer than 300 ft. to the nearest highway.

This may be taken as a major legal victory for the private airport if the decision is so entered on the book, for in spite of voluminous and damaging testimony against the ariport, the judge is refusing to find that it is a nuisance in the ordinary course of operations.

Aeronca sales staff appointments made recently include the following:

District Managers: Aero-Ways, Inc., (Eli Ellison) Cleveland; Al Leeward, New Kensington, Pa.; St. Joseph School of Flying (L. A. Hood) St. Joseph, Mo.; Baxter & Alverson, Lexington, Ky.

Distributors: Harry B. Combs II, Denver; Ross E. Thompson, Albuquerque, N. M.; Dave Lewis Aircraft Co., Portland, Ore.; Cincinnati Aircraft Service, Cincinnati, Ohio; P. E. Luce, Titusville, Pa.; W. T. Wagner & B. A. Levy, Dayton, Ohio; D-H Aircraft Sales Co., Pine Bluff, Ark.; A. R. Smith, Aberdeen, Miss.

Dealers: Earl Baber, Galesburg, Ill.; L. S. Cox & James W. Barnhill, Owensboro, Ky.; Land O' Lakes Flying Service, Pontiac, Mich.; Meyer Flying Service, Hendersonville, N. C.; Midwestern Aviation Corp.; Seymour, Ind.; Olympia Air Transport Corp., Olympia, Wash.; Peoria Flying Service, Peoria, Ill.; Orangeburg Flying Service, Inc., Orangeburg, S. C.; James O. Powers, Timmonsville, S. C.; John Heasty, Ardmore, Okla.; Virginia Air Service, Inc., Gordonsville, Va.; Allen M. Hoffman, Bay City, Mich.; Alfred A. Hudgin, Tucson; Thomas Thorson, Clarks Point, Bristol Bay, Alaska.

One hundred members (representing more than 1,000 soaring pilots throughout the country) attended a two-day convention of the Soaring Society of America held at Roosevelt Field in February. A ten-point program was adopted, including the creation, through government aid, of a national motorless flight institute at Elmira, N. Y. The 10th annual glider meet will be held at Elmira from June 24 to July 9, with cash prizes of at least $10,000. Foreign glider pilots will be invited to give exhibitions at the meet, but will be excluded from participation in the prize contests. Henry Wightman of Montclair, N. J. was elected general manager, succeeding Lewin Barringer; Richard C. du Pont is president.

WORLD TRAVELERS: Chief engineer Raymond Carlson and Mrs. Carlson are studying light plane designs in Europe.

DARK CONTINENT BOUND: A fleet of Aeronca Chiefs awaiting shipment to South Africa.

A bond issue of $3,000,000 for completion of the Los Angeles Municipal Airport development program is being sought at the May 2 general municipal election by Col. R. B. Barnitz, director of the airport. Airline executives, aircraft manufacturers, and civic leaders are all supporting the move to provide funds with which to develop Los Angeles airport facilities in order that all airline operations may be concentrated at this one field. The funds sought would be divided as follows: Hangars, $1,000,000; administration and passenger terminal building, $750,000; runways and field improvements, $750,000; garage building and utilities, $100,000 each; architectural and engineering costs, $200,000. Barnitz forecast an annual income from the field of approximately $150,000, as soon as the additional facilities are provided.

MANAGES PACIFIC AIRMOTIVE: Ray Sullivan, widely known Pacific Coast aviation executive and private flier, has been appointed general manager of Pacific Airmotive Corp., according to announcement of Palmer Nicholls, president. Sullivan has been acting general manager for some time and has been in the employ of Pacific Airmotive almost since its inception in 1928.

Far sighted realtors have realized the importance of landing fields to the development of real estate but it took the Massachusetts Real Estate Exchange to do something about it. At a recent meeting this group, under the leadership of President Rodney Long, passed a resolution requesting the state to develop Flight Strips as advocated by Col. Stedham Shumway Hanks of Boston. A bill has been introduced in the State legislature providing for the construction of such a landing area in the City of Revere.

In this year's Bendix Race Inez Gibson, California woman stunt pilot and charter service operator, has announced she will contend for the honors and cash. Miss Gibson is buying a modified type Northrop A-17-A plane said to have a cruising speed, at altitude, of 278 mph.

Gladys O'Donnell will run a speakers' bureau to help promote public interest in the U. S. aviation defense program. The Southern California Chapter of the N.A.A. is responsible. Speakers will be provided on call by service clubs, and other organizations. The staff of speakers now includes Gladys O'Donnell, Pat Lyon, Bertrand Rhine, and Dr. Earl Hill.

Evildoers beware because The Los Angeles County Sheriff's Aero Squadron recently established new headquarters at Grand Central Air Terminal, Glendale, Calif.

THE REPORT CARD

Of Air School Developments

Installation data on airplane engine and accessories have been compiled for a new advanced home-study engineering course announced by the Westwood Correspondence School of Los Angeles. According to the school announcement, as much as one-fourth of the engineering involved in development of a new airplane design is spent on engine installation problems alone, yet there has been a lack of coordinated data on such powerplant installation practices. The new Westwood course in Airplane Engine and Accessory Installation, includes fuel, oil, exhaust, induction, and cooling systems, engine controls and cowling. The course also treats fully test procedures and operating and maintenance requirements.

STUDENT ADVISER: Donald E. Blasdel has been appointed student guidance and employment director of Aero Industries Technical Institute, Glendale, Calif.

SUN SHOOTER: Charles A. Zweng of Pan American Navigation Service shows how it is done.

L. A. city schools have increased capacity for aviation students according to Theodore M. Woolsey, chief of the Aeronautic's Department of the Frank Wiggins Trade School. A maximum of 200 students per year will be handled. Courses taught include both aircraft design and aviation mechanic training. The increased facilities are necessitated by the current demand for skilled workers, Woolsey said.

Ryan enrollments have hit a new high figure for its seventeen years of operation. Twenty-one new students were signed up during February alone. New facilities have been provided for the aeronautical engineering school through construction of a second-floor addition to the Ryan Administration Building on Lindbergh Field, which will be dedicated with the opening of the Spring Term, April 3rd. Under the direction of Stanley H. Evans, formerly with Douglas and Northrop, one and two year courses in engineering are now being given, properly correlated to shop work.

TREASURY WATCHDOG: Roger Crawford, new Secretary-Treasurer of California Flyers, Inc.

PESCO HELPS CHICAGO AND SOUTHERN *STREAMLINE* "OLE MAN RIVER"

FLY C&S

With the return of the "Rainbow Flight" to its schedule this month, Chicago and Southern offers three round trips daily between the Great Lakes and the Gulf.

C. & S. flies the "Valley Level Route" from Chicago to New Orleans, and connects with every transcontinental air-line.

Schedules are carefully designed to offer the traveling public quick access to every important city in the Mid-West and South.

Chicago and Southern has made over 20,000 scheduled flight landings in the last 2 years with *no delays caused by fuel pumps.* ***That's dependability!***

● Pertinent to its outstanding record for flying "on schedule," Bruce E. Brown, Vice President of Chicago and Southern, in charge of operations, states: "Chicago and Southern pays tribute to the superior performance and efficiency engineered into PESCO fuel pumps—standard equipment on all our transports."

AIRCRAFT PESCO PRODUCTS

PUMP ENGINEERING SERVICE CORPORATION

Specialists to the Aviation Industry

12910 TAFT AVENUE • CLEVELAND, OHIO, U. S. A.

Measures for Defense

(*Continued from page 21*)

it has no intention whatever of otherwise disturbing the present distribution . . . As far as is possible the Corps hopes to avoid loading up with great numbers of airplane types which might soon become obsolescent. Since it considers long range bombers less subject to obsolescence than most other military aircraft, we can expect a considerable emphasis in that direction.

More men, more bases

The regular officer strength of the Army Air Corps is now 1,638; its regular enlisted strength is something around 19,000. For the new expanded strength it is estimated the Air Corps will need some 6,200 officers and 45,000 men. The programs which the Army will use to close that gap have been the source of misunderstanding.

Chief confusion is caused by the Civilian Pilot Training program of the Civil Aeronautics Authority for which the President suggested $10,000,000 per year in his January message. From a defense standpoint, that program is simply to develop a pool of civilians from which the Army and Navy might draw partly trained material in case of War. As AVIATION readers know, it will be carried out under C.A.A. direction at civilian flying schools using civilian instructors. The students enrolling will be under no direct military obligation whatever. It's goal has been set at 20,000 graduates each school year, each graduate to have received from 35 to 50 hours of training. It is already under way on a trial basis at some 13 colleges using funds supplied from the Federal Youth Administration. Incidentally, funds for its first year (1939-1940) of full operations throughout the country are now specified in identical House and Senate bills at $7,300,000—not at the original figure of $10,000,000.

Completely separate from this is an *Army* plan to use some of the larger commercial flying schools to give Flying Cadets the first three months of primary flight training now normally given at the Air Corps Training Center at Randolph Field, Texas. The students will be full-fledged Cadets living on a 100 per cent military status. They will be obligated to continue their training upon completion of this course, just as if they were at the Training Center. Considerable direction will be given by military personnel and civilian instructors engaged in this work will first have received an indoctrination course in army instruction methods at Randolph. After such a course the students who survive elimination will proceed to Texas where they will be given a basic three months course at Randolph, then a three months advanced course at Kelly Field. Under this arrangement Randolph will be relieved of most of the time-consuming primary work, it now gives and be able to devote all of its facilities to basic training. Fortunately Kelly Field already has a far larger capacity than the previous flow of students has required. A set of new buildings is nearing completion; the old ones (which were to be torn down) are still standing and will be left in that condition.

Expansion Bill

The Air Corps Expansion Bill mentioned above provides for a total of 3,203 Regular Army officers and 3,000 Reserve officers on active duty. Actually the Corps plans to have a total of 4,663 Regular and Reserve officers on active duty within two years. The Regular officer strength is to be stepped up from its current 1,638 to its ultimate of 3,023 over a ten-year period to avoid creating a hump in the Army's promotion list.

The influx of new enlisted personnel will also pose a training problem of almost wartime demensions. At present enlisted mechanics are trained at the Air Corps Technical School at Chanute Field, Ill., and at its branch at Lowry Field, Colo. Plans are underway to speed up instruction processes at those bases, but it may well be necessary to draw on the facilities of commercial mechanic schools throughout the country to help in the assimilation of the new men.

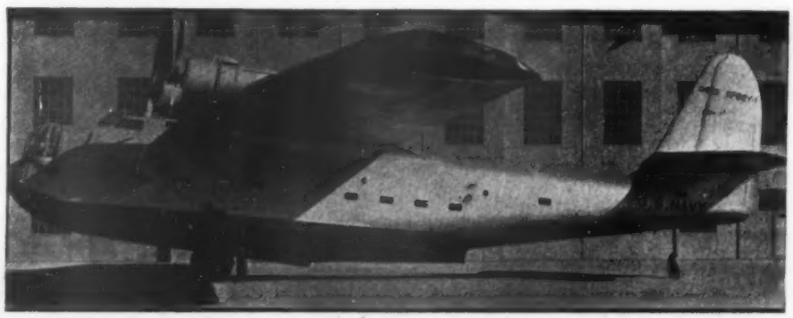
The Air Corps base problem is simplified by the fact that the Wilcox bill of 1935 already gives it all the authorization it needs to construct additional bases. Also, the W.P.A. and other governmental programs of work relief have already enabled the Corps to increase its hangar and field facilities throughout the country to a large extent. Actually the $300,000,000 estimate of the Air Corps increase provides for the ***beginning*** of some five new bases of first class importance; two in the United States, one in Puerto Rico, one in Alaska, and one in the Panama Canal Zone.

So much for the Air Corps. The Naval side of the program, if less spectacular, is no less worthy of study.

The Navy's plans

Unlike the Army, the Navy already possessed all the authorization it needed for expansion of its air fleet. Last year the so-called Billion-Dollar-Navy Act, otherwise H.R. 9218, contained the following passage: "The President of the United States is hereby authorized to acquire or construct additional naval airplanes, including patrol planes and spare parts and equipment, so as to bring the number of useful naval airplanes to a total of *not less than* three thousand."

Now, get that *"not less than."* The pre-1938 program called for some 2,100 modern planes for our naval arm by July 1, 1940. The most common outsider's estimate sets its current strength at about 1800. The usual interpretation of the Billion Dollar Act pictures the Navy building *up to* 3,000 by the time the new vessels for the fleet are ready. The usual cost estimate for that building up is set at $125,000,000. Actually last year's



Navy buying will stress big patrol-bombers. Above, the Consolidated XPB2Y-1

naval appropriation bill allowed $27,211,100 for acquirement of planes for the naval air service—hardly a spectacular beginning. But this year the Navy department will ask for $41,261,047 at hearings about to open in Washington, on the 1940 Naval Establishment Appropriation Bill. And in addition to this, remember, the President has asked Congress to appropriate $21,000,000. And this something over $62,000,000 worth of new planes should give the Navy a good boost along.

The Navy is even cozier with its plans as to types than the Army. But recent testimony and design projects have shown up an intense Navy interest in increasing its quota of big multi-engined patrol planes. Look then for some substantial orders in the near future for these big sea-going craft.

With far smaller numbers involved in its expansion plans for the near future, the Naval Air Force faces a much less severe training problem than does the Air Corps. Save that it may benefit in a general way from being able to draw already-selected material from graduates of the C.A.A. program, the Navy has no plans for changing its standard Pensacola training routine in any way. With some enlargement, that station should be adequate to handle all the Cadets required. More serious is the problem of attracting a high quality of cadet material in the face of the Army Air Corps Cadet's enlarged chances for a Regular Army commission. So far, Naval Flying Cadets, who are not graduates of the Naval Academy, have no other status save that of Reserve officers on active or inactive duty. The fundamental objection of making Regular naval officers out of them is that they have not been trained for any other naval duty, and, as they reach advanced ranks, would therefore present serious administrative problems. Whether the solution will be some type of flying corps within the Navy, along the lines of the Marine establishment or patterned perhaps after the British Short Term Commission system, remains to be seen. Rear Admiral Arthur B. Cook, Chief of the Bureau of Aeronautics, recently told a congressional committee that the navy is giving serious consideration to the problem.

If the Navy needed no authority to build new planes, it did face the necessity for getting Congressional permission to enlarge its base facilities. As has been widely reported in the press, the House of Representatives has approved the so called Hepburn base report with the sole exception of a project to improve harbor facilities at Guam. As we go to press, the Senate seems prepared to do likewise. Included in the list authorized were bases at Kaneohe Bay (Hawaii), Midway Island, Wake Island, Johnston Island and Palmyra Island in the mid-Pacific area; Kodiac and Sitka in Alaska; and San Juan in Puerto Rico. Also included were enlargements in the training facilities at Pensacola; in the Fleet Air Base at Pearl Harbor; in the Naval Aircraft Factory at Philadelphia; and in the Naval Air Station at Hampton Roads, Virginia. Several of these bases are, on the surface, apparent duplications of Army base facilities. In this regard Admiral Cook has stated, "There is no assurance that these ships will remain at those bases during wartime, but will go wherever the fleet goes or needs their services. If the fleet is in the Atlantic, the majority will go there; if the Fleet is in the Western Pacific, they will go there; if the Fleet is up in the Aleutians, they will go there; so that no naval aviation unit based at any particular point can be considered as a part of the fixed defense of that area."

This, like any other *authorization* bill, has so far resulted in no actual appropriation of funds. In hearings before Congressional committees considering it, however, the cost during the next three years for these projects is estimated at $53,800,000. Presumably it will be forthcoming in naval appropriation acts within that period.

Developing the ERCO Airplane

(*Continued from page 38*)

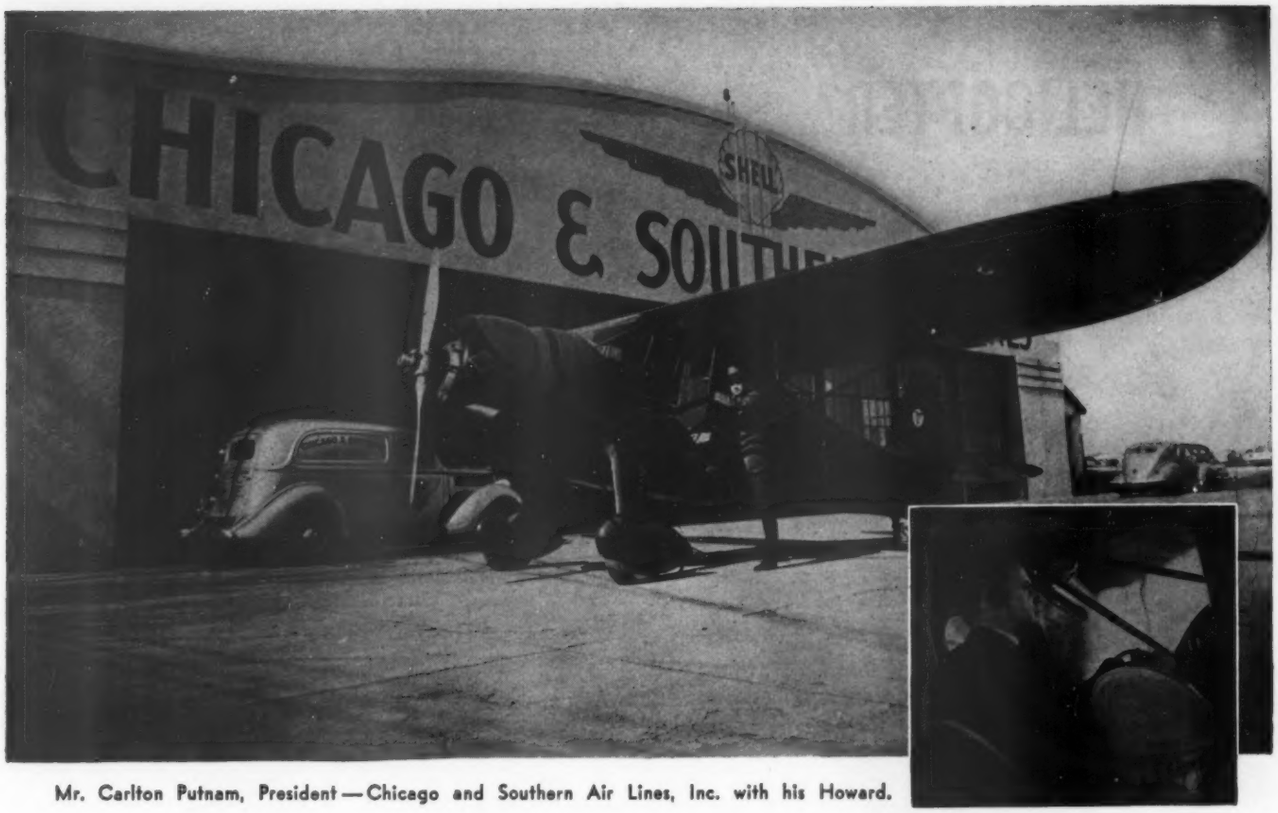
power at enough different points along the take-off path to cover the entire possible range. In some cases he had to make fairly sharp downwind turns and land with the wind in order to get back in the field, and in making these turns it was apparent to him that the airplane was often flying at an entirely different attitude than that which he would have maintained had he had the conventional three controls. The two-control airplane was flying correctly with respect to the air, but the pilot could not see the air and had to fly on the basis of his view of objects on the ground and his "guesstimate" of the wind velocity. He had originally intended to repeat the trials with all three controls in use for comparison, but he changed his mind and cancelled that part of the program on the basis that he was sure to slip and thereby lose altitude so that he could not complete his turn from the same height.

While we are on the subject of the effect of high winds, it is probably worth while mentioning that during the year and a half that the experimental model has been flying, no wind has been encountered that has hindered handling on the ground, taking off, or landing. The plane has operated in high winds many times, in one case the Weather Bureau reporting gusts up to 56 M.P.H. It has been taxied with ease in every direction in the strongest winds that it has happened to be operating in, and has never encountered any difficulties or required any outside assistance.

As in the case of obtaining freedom from stalling difficulties, the problem of obtaining satisfactory two-control operation is more complex with a tractor airplane than with a pusher. The W-1 had two sets of fins and rudders, one on each boom, and being outside of the propeller slipstream, there was no noticeable difference in directional trim with variation of power. In the case of the conventional tractor, however, the twisting slipstream passing the body and the vertical surfaces causes the directional trim to change as the power is increased. With a right hand propeller the vertical surfaces, which are ordinarily above the center of the slipstream, receive in effect an increasing blast from the left, and the rudder must be deflected toward the right to compensate for the effect and maintain the plane on a straight course.

In two-control operation it is desirable that the directional trim remain unchanged throughout the entire range of speeds and throttle settings. This condition is obtained without added mechanism in the Erco tractor design by providing two sets of vertical tail surfaces and placing them at the ends of the horizontal surfaces as in the case of the W-1.

Our flight trials and experiences to date indicate that the new Erco plane has a minimum number of things for the pilot to control or to think of, and that it is free from all treacherous characteristics, such as loss of control due to stalling, spinning, nosing over, and ground looping.



Mr. Carlton Putnam, President — Chicago and Southern Air Lines, Inc. with his Howard.

Airline Executives and Pilots like the Howard

Airline Executives like the Howard because its extra speed and higher *USEFUL* capacity permits them to make "off line" visits in the interest of Traffic, and for other purposes, in less time and with more load.

Airline Pilots, left free to choose, will usually select the Howard for practice in "instrument" flying and similar uses because it "arrows" through tough going and has exceptional stability at slow speed with power off for "blind" approaches and landings. They also like its "get up and go" performance.

The Howard is now designed so that it can be easily converted for many special uses without excessive cost. If you have a "flying problem" for an airplane in the 4-5 place category which has speeds up to 200 M.P.H. and *useful* capacity up to 1700 pounds, consult us, as the 1939 Howard may be the answer.

Howard AIRCRAFT CORPORATION
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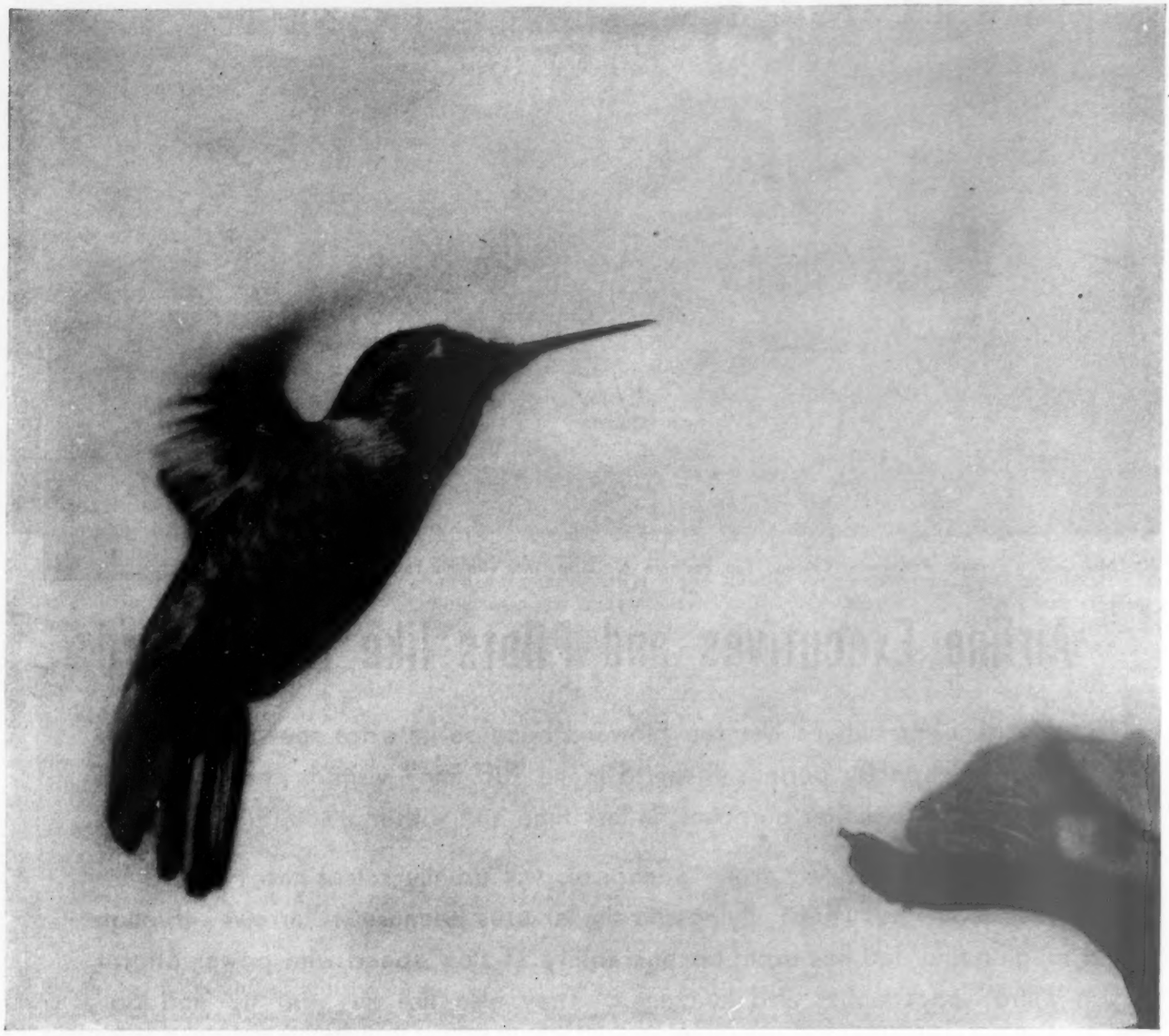
HELICOPTER?



CLOSER and closer man comes to practical vertical flight. But it's an old story to this little fellow... a Black-chinned Humming-bird. He can not only rise vertically and hover in mid-air, but he can actually fly backwards. To attain this unusual performance nature has given him an unusual "power plant" that turns up 12,000 wing beats a minute.

Flight, whether bird or man-made, vertical or horizontal, is inseparably linked to power. Through steady improvements of fuels and engines, aviation has conquered the "impossibles" of centuries. It is logical to assume that these advances will continue... and they must continue to come from improvements in fuels and engines.

That aviation engineers will always have fuels available that permit further progress, Ethyl engineers are daily aiding in practical research . . . to help provide tomorrow's fuel for tomorrow's plane.

ETHYL GASOLINE CORPORATION, *manufacturer of anti-knock fluids containing tetraethyl lead*

Stacks and Rings

(*Continued from page 29*)

has 2 outlets, one on either side of the airplane. One outlet handles 5 cylinders and the other outlet the remaining 4 cylinders. By reference to Table 1 the minimum size tube of sufficient area can be selected for each section of the collector. For the exhaust elbow from each cylinder, 2-½" tube; main collector of 1st cylinder, 2-½" tube; at 2nd cylinder, 3-½" tube; at 3rd cylinder, 4-½" tube; at 4th cylinder, 5" tube; at 5th cylinder, 5" tube.

In the collector shown in Fig. 1 the main collector at the 4th and 5th cylinders is fabricated from sheet material to approximately a tubular shape. In many cases this last section of a collector ring is elliptical in shape to reduce air resistance where it protrudes below the ring cowl. The elliptical shape is also necessary at times to obtain clearance with the adjoining engine or cowl.

It should be noted that there is no increase in size of the main collector when the 5th cylinder is picked up. A careful examination of Fig. 1 will show that the last exhaust elbow joins the main collector just above the outlet. Insofar as the cross-sectional area of the main collector is concerned this last elbow is practically an independent short exhaust stack. Joining it to the main collector does serve a useful structural purpose however. All but the last section of the collector ring are doubly supported —at the exhaust port, and at the joint or joints with the adjacent sections of the collector. By attaching two elbows to the last section of the collector ring it can be adequately supported without the use of an auxiliary brace. This method of supporting the last section does have the disadvantage of not allowing for expansion. This problem will be discussed in detail under the subheading "Structural Considerations".

When exhaust collectors contain intensifier tubes or other restrictions to free flow of the exhaust gases it is necessary to increase the cross-sectional area even more than the amount taken up by the intensifier tube or restriction. To maintain a low back pressure it is recommended that a factor of .045 square inches per horsepower be used in this case in place of .04.

When long tail pipes are used it is advisable to increase the computed area of these pipes by 25% to prevent a build-up of back pressure.

Shape and Location

The shape of an exhaust collector is determined by the location of the engine exhaust ports and the best location for the collector outlet. In general, short elbows carry the gases from the exhaust ports to the main collector ring as shown in the accompanying photographs. The main collector ring may have either 1 or 2 outlets. The location of the exhaust outlet should be determined after consideration of the following points:

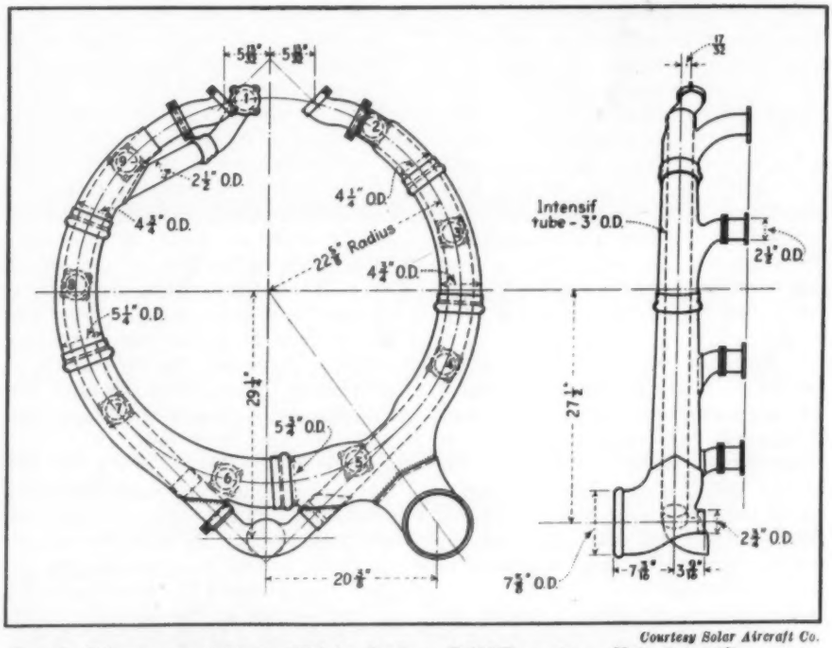
1. Fire hazard—The exhaust gases must not impinge directly on any portion of the airplane structure within 4 feet of the outlet. To meet this condition the exhaust collector is usually extended from 2 to 5 inches beyond the cowling line. It is also dangerous to run any portion of an exhaust collector under gasoline tanks or drains.

2. Carbon monoxide—The exhaust gases, which contain large quantities of carbon monoxide, must not pass near the cockpit or cabin or any openings in the fuselage that lead to the cockpit. The presence of more than .01% of carbon monoxide in the air is sufficient to cause headaches. The method of measuring the carbon monoxide content of cockpits or cabin is described later under the sub-heading Measurements.

It is common practice to make use of the propeller slipstream to carry the exhaust gases clear of the cockpit.

In the single outlet type of collector shown in Fig. 3 the outlet is located on the right side of the airplane where the propeller slipstream will carry it down and under the airplane as far from the cockpit as possible. In the two outlet type collector shown in Fig. 1 the outlets are located below the airplane. The rotation of the slipstream will carry the exhaust from these bottom outlets about 18 inches up on the left side of the fuselage. This is not usually critical unless there are openings such as gun chutes, recesses for retractable landing gears, or other openings in this region that are more or less inter-connected with the cockpit. If such openings exist excess quantities of carbon monoxide will be found in the cockpit. The connections between these openings and the cockpit must be completely sealed to prevent

(*Turn to page 80*)



Courtesy Solar Aircraft Co.

Fig. 3. Exhaust manifold for Wright Cyclone R-100-F engine. Note intensifier scoop and tube installation with scoop inlet located behind engine cylinders. This assures a supply of dry air under all atmospheric conditions. Note also the single exhaust outlet in the lower right quarter.

Stacks and Rings

(*Continued from page 79*)

the entrance of carbon monoxide. The location of the carbon monoxide "leak" into the cockpit can be readily determined by using the Carbon Monoxide Indicator described later under Measurements.

In open cockpit planes or the convertible type employing a sliding hood the velocity of the air past the plane sucks the air out of the cockpit. The suction in the cockpit then draws air from the remainder of the fuselage which in turn sucks air in through any openings in the skin. If any of the openings are in the exhaust flow, carbon monoxide will be sucked into the cockpit. One remedy for this trouble is to install pure air openings in closer proximity to the cockpit than the impure exhaust gas opening. The cockpit needs will then be satisfied by the pure air opening and no suction will exist at the impure opening. Another effective method is the installation of a gas tight bulkhead, either metal or cloth, between the cockpit and the fuselage opening.

3. Vision—The exhaust outlets must be so located that the luminous discharge at night will not interfere with the pilot's vision and will not be visible to passengers. After dark the exhaust flame is quite visible and would frighten passengers. The glare from this flame can interfere seriously with a pilot's vision. On single engine planes exhaust outlets located on the lower right side, or the bottom of the plane are satisfactory. On multi-engine airplanes the exhaust outlets should be located on the outboard side of the engine nacelles or in such position they are hidden from the cabin by the wing. In a low wing transport it is a relatively easy matter to exhaust just below the wing.

4. Noise—Exhaust outlets should be located to minimize the noise reaching the cabin. In general the best location in this respect will be the same as for Vision. The extension of the collector to place the outlet aft of the cabin will reduce the noise considerably but the increase in weight due to the long extension is seldom justified.

The choice between a single or double outlet for the exhaust collector depends upon several things. The advantage of the single outlet as shown in Fig. 3 is that it can be located in a spot that will avoid carbon monoxide trouble, or exhaust glare. The disadvantage is the large size of a single outlet. If a tail pipe is required to carry the gases aft this pipe must be very large and heavy and will cool poorly because of the reduced ratio of external cooling area to internal volume as the diameter increases. These arguments apply chiefly to the larger engines developing 1000 horsepower or more. The single outlet and tail pipe works out very nicely for the 400 horsepower installation shown in Fig. 2. In this case the tail pipe is well exposed to the slipstream which insures adequate cooling. It also serves a useful purpose in heating the cabin air.

The two outlet type collectors shown in Figs. 1 and 4 are somewhat easier to construct and are small enough to fit conveniently in the space normally available. They also have the advantage of leaving an open space at the bottom of the fuselage which is an excellent position for mounting an oil cooler. The big disadvantage of the two outlet exhaust is the wide area covered by the gases as they are swept rearward by the slipstream. In the larger engine installations this makes the elimination of carbon monoxide from the cockpit very difficult.

To minimize back pressure the flow path of the exhaust gases must be kept as smooth as possible. All bends in the exhaust elbows or collector should have a radius of curvature of 3 times the diameter of the section. The collector should be designed so that tangential flow exists at all points of intersection. The exhaust elbows from the cylinder ports should be curved so as to enter the main ring as nearly tangential as possible. The intersection of the elbow centerline and that of the main collector ring should form an angle of less than 30 degrees. The fillet at the actual intersection of these tubes should have at least a $\frac{1}{2}$ inch radius. With the proper care in laying out a smooth collector shape and the elimination of restrictions or roughness within the collector it is possible to keep the back pressure very low. It is frequently impossible however to design a collector to these optimum conditions. If the design is such that the back pressure is excessive at one or more points it is possible to reduce this pressure by directing a jet of cooling air at the offending spot. By reducing the temperature of the exhaust gas the pressure is also reduced. Cooling the entire collector is also beneficial in the same way.

Exhaust collectors for in-line engines are designed on the same principles as radial engine collectors. The main collector pipe is fairly straight and extends from the front to the rear of the engine where it discharges. In "V" type engine installations an independent collector is run on each side of the engine. The location of the exhaust outlets must be carefully selected to protect the cockpit from carbon monoxide fumes.

Dawn Patrol

(*Continued from page 25*)

the school has been known as "The Home of the Dawn Patrol".

The Dawn Patrol gradually became a more formal organization until today it is the council of all Spartan students which holds regular meetings, elects its own officers, conducts both business and social projects, and acts as official representative of the students to the school officers. Each student on enrollment receives a silver pin in the shape of wings with Spartan letter "S", and on graduation he receives a card of life membership in "The Dawn Patrol".

Of course the personnel is constantly changing with the enrollments and graduations, but a program of sports, dances and contests keeps the organization intact. Competition within the group is keen, and every month or so, spot landing contests are held. Advanced students are handicapped, and a small entrance fee is collected to buy a prize for the winner. Participation in various air meets had won the Dawn Patrol many prizes and trophies. Several outstanding citizens of Tulsa, and other cities, who have proved themselves special friends of The Dawn Patrol have been named honorary members and awarded honorary pins and cards.

Though the fun of the cross-country flights bulks large in the students' minds—the banquets, dances, sports and entertainments—after all, the primary purpose is cross-country flying experience for student pilots and mechanics. The Spartan School has found these cross-country flights in a group to be invaluable to aviation students from every standpoint of instruction. The project begins with thorough inspection and tuning up of the planes. Courses must be plotted, involving map reading, use of weather

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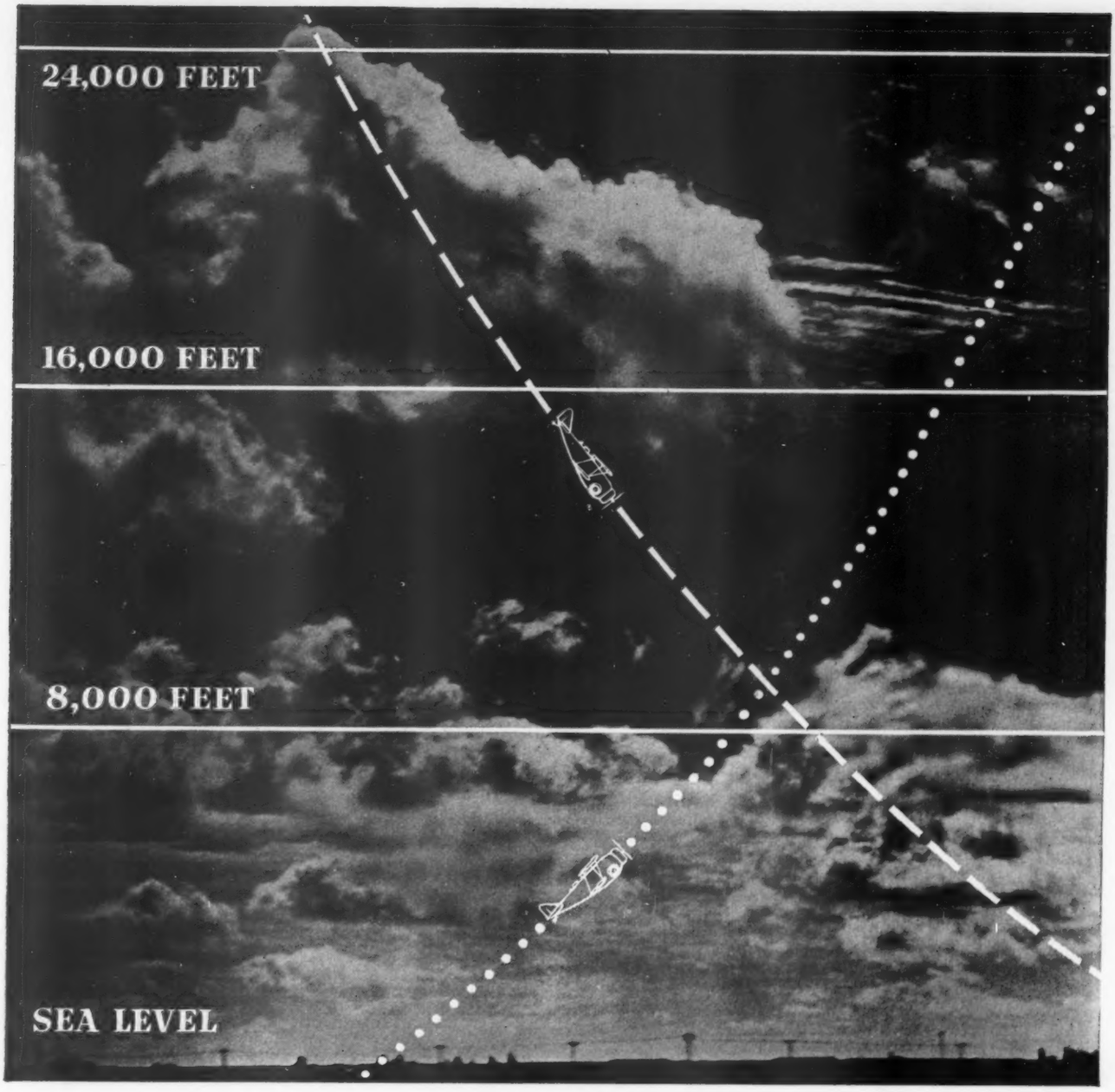

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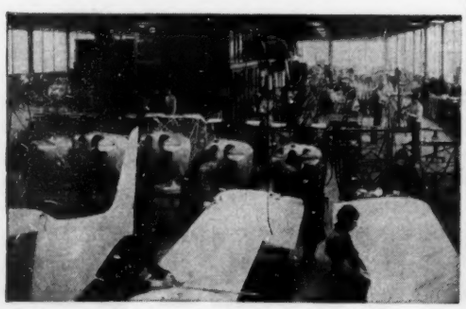

Grooming Canada's Aircraft Industry

(*Continued from page 23*)

capitalized at $1,250,000, in which the common stock is all owned by the six component aircraft manufacturers, a small amount of preferred stock is owned by interests not directly associated with the aircraft industry, and all shareholders are British subjects with component companies being entirely British Empire controlled.

To take care of this initial order for bombing planes and subsequent orders by the six component companies, these and other companies are undergoing considerable plant extension. In the past two years plant extensions have gone ahead among Canadian aircraft manufacturers. This year will see more extensions. Similarly the number of employees is growing. Most Canadian companies reporting on a survey made for this article show that before the end of this year they expect from 50 per cent to 100 per cent increase in their personnel. Most of the young men working in Canada's airplane plants come from technical schools and the few aviation schools operated in the Dominion.

Individually the Canadian companies line up shows that De Havilland Aircraft of Canada, Ltd., has a plant at Toronto, to which recently has been added 20,000 sq.ft. at a cost of $100,000. With 140 men at work during the winter and early spring months the company was producing one Tiger Moth Trainer a day on a 200 machine order for the parent factory in England. The planes were shipped without engines. The company has been in Canada for 12 years, has built many light planes for private fliers, training ships for the Royal Canadian Air Force, patrol ships for the Royal Canadian Mounted Police, and for commercial Canadian transportation. The company builds and distributes De Havilland aircraft and Gipsy engines.

National Steel Car Corporation with head-office at Hamilton, Ontario, built a new plant on a 33 acre site at Toronto in 1938 at a reported cost of $400,000. The plant is some distance from the nearest fire station, and has accordingly built a rain water storage tank which can be used with powerful pumps for fire fighting. The plant employs 340 men and is working under license on an order of 28 Westland Lysander fighters for the Canadian government, on which production is to start in May, in addition to its share of the parts manufacturing on the Handley Page Hampden bombers.

Fairchild Aircraft Ltd., Longueuil, Que., is building an extension to its plant with its own airport and seaplane base this summer. With 300 men employed during the winter and early spring, to be doubled later this year, the company was working under license on a number of modified English Bristol Blenheim aircraft for the Canadian government. The company represents Lockheed Aircraft Corporation in Canada as sole selling agents for all products, and has manufacturing rights for the Lockheed Electra.

Canadian Car & Foundry Co., Ltd., Montreal, have leased a plant at Lachine, Quebec, for the parts manufacture of Handley Page Hampden bombers on the British Air Ministry order. The company also has a plant at Fort William, Ontario, where Grumman fighters are produced. At Fort William it is unofficially understood pursuit planes are being built for the British Air Ministry. The company is also arranging for a branch factory in Mexico in a co-operative set-up with the Mexican government.

Canadian Vickers, Ltd., oldest of Canada's post-war aircraft manufacturers, has ample space to take care of its military orders, and plans to increase its personnel from the present 400 to 600 before the end of 1939. In the 103,000 sq.ft. plant at Montreal, Vickers have been building flying boats and land planes for the Canadian government since 1923. In addition to orders from the central assembly organization, Vickers is building under license 20 Northrop Deltas and 10 Supermarine Stranraer Flying Boats (largest ever built in Canada) for the Canadian government. With the completion of this order Vickers will have built 206 aircraft of different types (Vickers, Fairchilds, Fokkers and Bellancas) since its inception.

Noorduyn Aviation Ltd., has been manufacturing its own high wing monoplane Norseman designed for northern Canadian flying conditions and freighting since 1935 at Cartierville airport, Montreal. To take care of expansion it has leased this year a factory of 72,000 sq.ft. at Longue Pointe, east of Montreal, and will

Noorduyn's new plant at Longue Pointe, Montreal

National Steel Car Corporation plant at Malton Airport, Toronto, where 28 Westland Lysanders are being built

move from its Cartierville plant. It has no military orders at present though the Royal Canadian Air Force has bought some of its Norseman for training purposes. Since Noorduyn holds a manufacturing license for North American NA16 advanced trainers, 400 of which have been ordered by the British Air Ministry in the United States, it expects to receive orders for these ships from the Canadian government.

Ottawa Car Manufacturing Company Limited holds licenses for Armstrong Siddeley Motors, Armstrong Whitworth Aircraft and A. V. Roe & Co. In its 275,000 sq.ft. factory at Ottawa it has already started making parts for the Handley Page Hampden bombers, alterations to the plants being made at a cost of $175,000. Data on production is not available, but personnel will be increased during the year from 136 employed during the winter months to 275.

Fleet Aircraft of Canada Limited is making additions to its plant at Fort Erie, Ont., to take care of military orders from the central assembly set-up. It is also building training ships for the Royal Canadian Air Force. Orders last year were reported to total 128 planes at a value of $800,000. The plant has developed a freighter for Canadian conditions. Much of the production is for export, the company having exported in recent years to Central and South America countries as well as to China.

Boeing Aircraft of Canada is working on 17 Blackburn Shark bombing planes for the Canadian government, is employing about 200 men. The plant on the west coast is expected to receive some British military orders in addition to any handled through Canadian Associated Aircraft, of which Boeing is not a member.

Cub Aircraft Ltd., plan extensions to their plant at Hamilton, Ont., where they are producing light planes for private flying. No reports of military orders are available from this plant, although the company was represented at the sessions with the British Air Mission last year.

In addition to these aircraft manufacturers in Canada there are a number of accessory manufacturers and assembly plants for landing gears, skis and floats; for engine assembly and servicing. Aero engines are not manufactured in Canada. Among United States engines represented by Canadian branch companies are Pratt and Whitney, and Wright.

Canada's airplane industry has not made the strides that the airplane industry has in the United States because it is cheaper to import planes from the United States. What companies are operating in Canada have had a hard uphill battle. Only the possibilities of military orders has brought big finance into the airplane industry in recent years. Commercial operators with 512 planes in service at September 30, 1938, latest figure have bought some of their planes in Canada, have flown more across the international border from United States plants. The last year for which official figures are available, 1937, the Dominion Bureau of Statistics report 110 planes produced in Canada at a value of $1,461,626, whereas Canada imported the same year airplanes valued at $1,388,621 without engines, and engines and complete parts valued at $1,032,664.

While the first plane flown in the British Empire was piloted by J. A. D. McCurdy at Baddeck, Nova Scotia, on February 23, 1909, no more airplanes than those constructed by Dr. Graham Bell's young men were built in Canada till the necessities of the World War brought McCurdy to Toronto to build a factory to turn out planes for the British government in 1916. This was succeeded later in 1916 by Canadian Aeroplanes Ltd., the Imperial Munitions Board's own airplane manufacturing plant at Toronto. In twenty months this plant turned out 2,900 JN4 and Avro two seaters. In 1918 the United States gave the plant an order for thirty F-5 flying boats. Engines for all these planes came from England.

From the end of the World War till 1923 there was little done except servicing on Canadian war time airplanes. That year Canadian Vickers received its first government order for eight single-engined amphibians for the Royal Canadian Air Force. Then came a search for a Canadian airplane especially suited to Canada's lake studded northland, resulting in Vickers three place Vedette flying boat. By 1927 a number of other companies had started up, but Vickers still built practically all the Canadian airplanes, and that year started on Fairchilds. De Havilland's established a branch plant in Canada at Toronto that year, and Wright engines were then assembled and serviced from a plant at Montreal. In 1929 at the head of the pre-depression aviation boom Curtiss, Consolidated, Bellanca and Boeing entered the Canadian field, while Vickers received a Fokker manufacturing license. Canada's Empire tariff preferences brought some of these and other aircraft industries to the Dominion, primarily for export purposes.

With the 1929 crash and the drop in aviation interest, followed by a government economy campaign on the air mail and Royal Canadian Air Force developments, aircraft manufacturing came practically to a standstill in Canada. Only in the past three years has the industry taken a new lease on life, as the government decision to start overhauling defenses.

Dawn Patrol

(*Continued from page 80*)

information, working out navigation problems, and the location of intermediate fields in case of emergency landings. Arrangements must be made for refueling in accordance with the cruising speed and fuel consumption of the various planes. Pilots flying radio equipped aircraft must study locations, call letters and frequencies of airways radio stations along the route. They must be familiar with air traffic and airport rules, and must know how to care for their planes when away from the home base. No small feat is the actual piloting of airplanes in formation.

Some conception of the important part this cross-country flying of the Dawn Patrol plays in the flight instruction at the Spartan School may be gained from a summary of such flying during the past three years. In 1936 the Dawn Patrol made 25 cross-country flights, covering 25,000 miles. The largest party was thirty-five in a group of twelve planes which visited the Centennial Celebration at Dallas, Texas. During the year 26 different cities and towns were visited during cross-country flights to points in seven different states. In 1937 40 cross-country flights were made, covering 40,000 miles, most notable being to Cleveland, Ohio, to attend the National Air Races, with stops at St. Louis, Terre Haute, Indianapolis, Muncie, Chicago, and Springfield. In 1938 25 cross-country flights had been made up to June 30th, totaling 150 hours of flying and covering 15,000 miles. Longest trip was to Chicago to attend the International Aircraft Show in February, and the largest formation was a flight of 16 planes to Ponca City, Oklahoma, on April 30 and May 1. The contacts made on these trips are priceless to the student who is launching a career in aviation.